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WORLD HEALTH

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Contents

PART FOUR

PUBLIC HEALTH PRACTICE THROUGHOUT THE WORLD

PART FIVE

INTERNATIONAL PUBLIC HEALTH

PART SIX

THE MEASUREMENT OF HEALTH

APPENDICES

Foreword

JUST over one hundred years ago, in 1851, the first effort was made to reach international agreement on a health matter. The subject was quarantine and the occasion the first International Sanitary Conference held in Paris, and attended by representatives of twelve European States.

At that time few people had any notion of what is now called public health, preventive medicine was scarcely dreamed of, and the principle of the responsibility of governments for the health of their peoples would have been considered impracticable.

Today almost all the countries of the world have formally undertaken to join in a common endeavour not only to protect themselves from the spread of epidemics, but also to attack communicable disease wherever it is found, and to raise the health standards of people everywhere. It is now a commonplace that health, like peace, is indivisible, and that it is in each country's interest that the peoples of other countries should live in healthy conditions. This common endeavour has its spearhead in the World Health Organization, which, with a membership of over 125 countries, is in 1968 celebrating its twentieth anniversary.

The disciplines of preventive medicine and public health have developed enormously in the last hundred years and particularly during the present century. They are, however, in their infancy compared with curative medicine, whose roots and traditions go back thousands of years. It is therefore not without difficulty that medical and administrative authorities are now coming to accept the incontestable need to integrate the curative and preventive branches of medicine and to introduce public health concepts into regular medical courses. Happily, the definition of health given in the Constitution of the World Health Organization – 'a state of complete physical, mental and social well-being' – is today being accepted more and more widely as an attainable, if distant, goal.

Professor Brockington's book attempts to present a clear exposition, based on historical, organizational, and practical considerations, of the public health approach and the world approach to some essential social problems of our times. Although students and public health workers will find here a treasure-house of information, this book is much more than a history. It aims at providing a synthesis of views current today on health questions, and as such it has great educative possibilities. It will also, I am sure, prove to be

a guide and an inspiration to young medical men and others who may be thinking of devoting their careers to a field which is full of promise for the future – that of public health.

M. G. CANDAU, M.D.
Director-General, World Health Organization

Geneva, May 1967

PART ONE

INTRODUCTION

CHAPTER 1

The Meaning of Health and of Public Health

PEOPLE talk of health today as of a known and measurable quantity. Yet even its meaning is elusive, and its wide use contrasts with any clear, distinct, or generally accepted definition. From its derivation, and in the picture which it presents to all our minds, it signifies a wholeness or soundness of body and mind. But when we seek to give this scientific precision, we are at once confronted with the difficulty of determining its relationship to 'disease'. Health and disease must be intimately related, for if disease did not exist it would be nonsense to talk of health. The two states are contrasted in our minds, as it were the two sides of a coin – so that when one is present the other is absent. The difficulty is to determine, as with light and darkness, at what point health and disease meet and whether they are mutually exclusive. If the most perfect functioning of the body is the light of the sun's zenith, and death the 'darkest hour', the point of distinction between health and disease can be anywhere in between. Health may be reckoned as beginning when there is light enough 'to distinguish between a light and a dark thread', or anything less than the zenith may be counted as disease.

HEALTH AND DISEASE AS DISTINCT ENTITIES

If health is present only at the zenith – the condition of perfect equilibrium and perfect harmony, which Galen postulated[5] – then it is a final goal, and all that leads up to it is disease. Here positive and negative and other qualifying adjectives have no place. Health is raised to the level of an ideal, a blessed condition, to be attained only in rare moments of life, when the body is sound and the personality is reacting to a major challenge – like a pale tenuous membrane stretched to its capacity (A. Huxley).[6] Disease becomes all but universal. Thus we are, at once, forced to ask ourselves what

is disease; for if we could define this might we not by elimination determine health?

Disease – a 'condition of the body, or some part or organ of the body, in which its functions are disturbed or deranged' (*O.E.D.*) – has by many been confined to those established pathological conditions which are clinically detectable. Disease is here what we see in the *pathological museum* – the results of invasions, toxins, degenerative processes, and accidents. Or it may include *sub-clinical conditions*, of which we may be unaware, detectable perhaps only by laboratory tests; or even a mere absence of *physiological reserves*, which in general parlance may be called poor health rather than established sickness. But over and above such distinctions there are more remote and more subtle deviations from normal which many include as illness. We now enter the realm of the body's reactions to stress, which play their part in the *milieu intérieur* of Claude Bernard.[2] The body may over-react to stress, or have an abnormal reaction to stress, or may simply be forced to react to too much stress. All of these may produce a condition of hormone over-dosage. Certain anterior-pituitary and adrenal hormones may be produced in excess.[10] And there may be others, whose internal injections could cause damage to linings, resulting perhaps in peptic ulcers, ulcerative colitis, or cardio-vascular disease. We are now removing from the group of healthy people all those who suffer in a physical way from the tensions of modern life.

Ill-health so far defined, if much wider than gross physical destruction, is yet restricted to conditions in which there are somatic changes. There remains the possibility of ill-health without necessarily any disturbance of the soma even so remote as an upset in 'homeostasis'. Social or psychological disturbances may not have given rise to stress greater than the individual physique can withstand; but there is still a distortion of behaviour, which may be regarded as illness, now purely a psychological phenomenon – the neurones are healthy, but they are arranged in socially undesirable patterns. Thus we may have to add to the swelling flood of sick people all those individuals who are at variance with the social structure in which they live; among these are to be found the isolates, delinquent children, industrial misfits, problem mothers, and neurotics, and even those who think themselves to be ill, or who escape from unpleasant situations by presenting symptoms of illness. It follows that failure of personal relationships everywhere, in spite of the fact that they may be a potent cause of stress and hence of somatic changes, are by many regarded themselves as illnesses.

At this point we realize that if health is the absence of sickness in this very wide sense, we approach once again the concept of universal sickness – a situation from which statisticians, and no doubt others, including health administrators, instinctively shrink. As William Farr said:[4]

> To accuse the human frame of perpetual malady is as ridiculous as to attribute, with some theological writers, unremitting wickedness to the human heart; but if every alteration of the multiplied parts of the human body, every transient tremble of its infinite movements, every indigestion in man and every fit of hysteria in woman, were reckoned, few days of human life would remain entirely clear; and if the same scrutiny were extended to the state of the brain, the world may very civilly be sent to Anticyra – *naviget Anticyram.*

Farr himself sailed in more frequented waters; and for his statistics of the health of the group he worked on the basis that 'in determining the amount of sickness, the attacks of disease, the slighter affections, are, therefore, passed over'.[4]

Galen, too, although considering that health in the abstract was an ideal state to which no one attained, was equally aware of the embarrassment of applying such a definition to the human race. He found difficulty in regarding as unhealthy all who do not function perfectly; as he said:[5]

> if anyone should say that only those are healthy who function perfectly in all their parts, and that we others who function less well are not healthy, let him know that he is undermining the foundation of the entire consideration of hygiene.

Furthermore, Galen maintained that it would in any event be impossible to maintain a constant state.[5]

> For if ever the perfect constitution existed, it would not remain unchanged for an instant. So that it occurs to me to wonder at the opinion of those who consider that health and good constitution are one and invariable, and who say that whatever departs in the least from this is not health; and introducing the concept of perpetual disease, they do not perceive that they are arguing about something which either never exists in the animal body or, if ever it should exist, does not last any length of time.

Galen, therefore, like Farr, was prepared to overlook small ailments and to accept as constituting health a state of reasonable functioning and freedom from pain:[5]

> that condition in which we do not suffer pain, and are not impeded in the activities of life, we call health; and if anyone wishes to call it by any other name, he will accomplish nothing more by this than those who call life perpetual suffering.

He added the rider that he would exclude from ill-health all those

conditions of impairment, or lack of vigour, which, as in ageing, are in accordance with nature.

Many believe that there is little to be added, eighteen hundred years later, except perhaps that health is not an absolute quantity, but a concept whose standards are continually changing with the acquisition of knowledge and with cultural objectives in different lands.

HEALTH AND DISEASE AS OVERLAPPING STATES

If, however, as has been cogently argued by Perkins (1950),[9] the dividing line between health and disease is placed in almost total darkness just on this side of death, then all life represents some measure of health. Even Falstaff on his death-bed, 'babbling o' green fields', will have had some health. In this concept not only does the absence of disease not exhaust the possibilities of health, but also health and disease can co-exist. It is attractive to think thus of health as a quality in its own right defined without reference to disease. We can then express it on a positive scale increasing to a point where there is not only a complete absence of demonstrable pathological conditions but an excess of physiological reserves, which is more than adequate for every potential stress (Stieglitz, 1949).[12] Furthermore, this permits of improvement in health and the building up of resistance in those who are not manifestly ill; it allows of the possibility of 'positive health' in which the individual glowing with health looks disdainfully at his merely healthy neighbour, as the very white looks at the nearly white in the soap powder advertisements. It was in terms of positive health that the World Health Organization framed the definition in its constitution that '*health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity*'.[14]

Some have gone so far as to postulate that health in this setting is not an end in itself and that any definition must contain also the idea of purpose. Man is a social animal; he cannot easily live for himself alone. Health that exists for selfish enjoyment alone is in this concept an affliction – at least on the mental plane. Health must then be the result of a conscious attitude. To be truly healthy a man must find a synthesis of his animal and social imperatives; there must be a harmony. Health is here an adjustment with the environment – physical, mental, social, and cultural – on all sides:

> Health is a state of feeling well in body, mind, and spirit, together with a sense of reserve power; based upon normal functioning of the tissues, a

practical understanding of the principles of healthy living, a harmonious adjustment to the environment (physical and psychological); it is a means to a richer life of service.

THE MEANING OF PUBLIC HEALTH

Public Health refers to the group as distinct from the individual. It suffers, like many phrases in common use, from double meaning, so that in this account of World Public Health we will sometimes be considering the *state of health,* but more usually the *body of knowledge and the machinery by which it is put into practice.* When we say that the Public Health is good or bad, we mean that the group or community is healthy or ill. Here we are in great uncertainty; even greater perhaps than with the health of the individual. What is health in a group? Is it the total of individuals' health or departure therefrom? Or is it that mixture of good and bad, which, reacting one on another, helps the group to grow and to prosper? Once again we are in the sphere of abstraction – not knowing, for example, whether to regard the neurotic as an asset or a debit. Can a community be healthy, we ask ourselves, without the creative ability of the neurotics – restlessly questing after strange sources of satisfaction?

We should voyage widely before reaching Anticyra in this search for a formula. Like William Farr we may decline the journey and follow Galen's lead in limiting our measurement of the Public Health to the sum total of 'human incapacity'.

In its other sense – the means to health – Public Health is the application of all scientific and medical knowledge for the preservation of the health of the group. The WHO Expert Committee on Public Health Administration, adapting Winslow's earlier definition (1923),[13] has defined it as:[15]

> the science and art of preventing disease, prolonging life, and promoting mental and physical health and efficiency through organized community efforts for the sanitation of the environment, the control of communicable infections, the education of the individual in personal hygiene, the organization of medical and nursing services for the early diagnosis and preventive treatment of disease, and the development of social machinery to ensure to every individual a standard of living adequate for the maintenance of health, so organizing these benefits as to enable every citizen to realize his birthright of health and longevity.

More simply Scheele said, 'Public Health is the basic institution created and maintained by society to do something about the death-rate and the sanitary conditions and many other matters relating to life and death'.[11]

In this sense it is both a body of knowledge and also a means to apply that knowledge. Here, at least superficially, we are on more certain ground. When society has determined what it means by health, and what it wants for itself, then Public Health is the way there.

Yet societies will ask different things of it in different parts of the world, and at different points of time. The recipe for health will not always be the same, since cultural values and beliefs differ. Mental health in one society may be ill-health in another. Public health in Japan and Thailand may be striving after objectives different from those it strives after in America or France. In Thailand time will have less meaning than in the U.S.A., and the value which the culture places upon absence of friction in all human relations will be greater. Value systems will also affect the means to Public Health. The place assigned to women – leadership, partnership, or inferiority – in a complex of other factors, will often determine the course of events. In Burma or Bali the needs of religion will take preference, and in Russia, the U.S.A., and Japan those of industry. Countries that hold nursing in high esteem will have an advantage over those that regard it as a menial task. Even the extent to which medical care will be wanted may be determined by the culture. Some nations, like Jane Austen's Mr Woodhouse, health conscious and hanging on the doctor's word, will want hospitals, medicine-bottles, and placebos; for others, asceticism and the inward fires of purposeful living.

Public Health, whatever conditions it has to face, is pertinent to all times and places. It is a science and art capable of adaptation to the physical and social demands of any country anywhere in the world.

CHAPTER 2

The Conflict of Living Matter

IF words do not allow a precise definition of health, we can seek an intuition of its meaning by studying man in his origins and through his associations with other creatures. This takes us to the study of the interplay of different forms of life, which is one aspect of ecology first defined by Haeckel in 1869. So far we have been considering the meaning of health in the abstract and our account has been homocentric in outlook, with man and his illness as its focal point. But in the turmoil of living matter man is a peripheral

figure. No longer the leading actor, but among the crowd, we are led beyond the drama of human life into 'earlier and other creation',[3] seeking the dominant features of life, and an understanding of man's submerged tendencies before they became changed by civilization 'into something rich and strange'. By finding man's place in the world of living creatures, we hope to learn what we can expect in health.

The biologist, who sorts out the chaos of living forms – not only in the animal and plant kingdoms, but also in the realm of single-celled organisms dwindling to the bacteria and the virus, almost molecular in size – defines the principal activities of life as growth and reproduction. Life proceeds in fits and starts with the cycle of generations; with each reproductive event there is an opportunity for variation in design; and through each period of growth that follows, the chance to test it. The slow development which we call evolution selects the designs which stand the stresses better. Growth depends on food gathering, which involves all organisms in an intense competitive struggle. The search for the materials of life is, therefore, the central problem which governs the interplay of living matter. No organism is an entity unto itself. The plants which manufacture their protoplasm from the air and soil, and thus make a real gain in living matter from the inanimate, are food for herbivorous animals. The flesh of herbivores is consumed by carnivores; these in their turn succumb to the attacks of others of their kind and bacteria. All flesh must die and feed the scavengers, when the multitude of small creatures, which seethe in rotting matter, return it to the air and to the soil.

In the confusion of this intense competition – life living upon itself and ever 'fire new from the mint' – the delicate balance of species is poised – sensitive to new conditions which might favour one more than another. The geographical units, with their dominant vegetations, or biomes – tundra, taiga, deciduous forests, grass land, desert, or marine[1] – each have their own community, whose numbers remain roughly constant. Herons in Britain, storks in Germany, great tits in Holland, if undisturbed, fluctuate in all available censuses within restricted limits – the highest frequently only twice, and never more than ten times, the lowest. Rhythmical swings from high to low – as illustrated by the ten-year cycle of the snowshoe rabbit in Labrador, or the four-year swing of the lemming or vole in the Northern Tundra – is the general rule, involving both the species observed and its predators.[7]

Restraint on numbers, achieved by high mortalities, is the out-

come. The robin has two broods a year, each with a clutch size of five; if all were to survive and breed, the population of robins would increase six-fold by the following year, and ten-million-fold within ten years. The robin has an infant mortality of 460 per thousand; the Michigan chipmunk nearer 900 – and annual deaths of the survivors leads to extinction of the cohort within five years. Yet, kept in captivity, chipmunks live to eight and robins to the great age of eleven. If, for a time, the restraint on population breaks down, numbers begin to grow exponentially, until disaster overtakes the swollen herd – an epidemic of disease, shortage of food, a sudden climatic catastrophe, as drought follows a heat wave, or an irruption, as seen in the lemmings and the locusts. The original balance is restored.[7]

Such is the law of life as we see it, and as the ecologist describes it; but when studied biochemically or genetically, it can be seen to obey a simpler rule. Growth and reproduction depend upon nucleoprotein. This substance is present throughout the scale of life in the nucleus of the cells. The simplest organism consists of little else. The virus bacteriophage, which lives on bacteria, has 40 per cent by weight of nucleoprotein; and when it invades a bacterium, this is all that enters the host, since the tail, with its injecting device and the armour of protein, are left behind. Nucleoprotein provides the activator which turns the bacterium into a factory for manufacturing virus. It is life stripped down to its essentials.

A compound of this relative simplicity is responsible for the endless distinctions in living things which we see around us. Chemical differences in nucleoprotein hardly exist from virus to the anthropoids; yet this substance is a design for the mature organism, 'repeated' in the patterns of nucleoprotein in the nuclei of its cells. Chains of nucleoprotein, each with the possibility of variation greater in total number than the number of atoms in the universe, contain the secret code of human life.

In the biological estimation of living matter, nucleoprotein has overtopped all. It was present at the beginning of life, though perhaps in a simpler form; 750 million years ago, when there was less oxygen in the atmosphere and the intensity of ultraviolet radiation was greater, and when, on the mud banks by the shallow seas, conditions were favourable for the making of many strange new compounds, one of these became self-replicating and the spark of life was struck. Nucleoprotein is the continuing principle which has survived since the conception of life, and undergone countless modifications.

Since nucleoprotein is extremely unstable, and in imminent danger

of disintegration under hostile powers of light, heat, and radiation, the central problem in the phenomenon we call 'life' has always been to survive. Had it not been so there would be nothing now for us to observe, nor ourselves to see it. Survival is the final value in nature. Nucleoprotein, under the menace of the physical world, has evolved endless accessory structures – for protection, for the gathering of food, for reproducing itself by interaction with other nuclear protein, always with the strengthening quality of variation. In these terms the bulky intricate organisms, colourful, diverse, and untidy, exist only to serve the germ plasm and to ensure its survival. Thus there exists fundamentally an interaction of different patterns of nucleoprotein, each under pressure to establish its seed upon the earth, and to convert matter into its own substance. This ecological struggle, in which animals die young and violently, is one in which man must also participate. Much of public health can be seen as a struggle to escape from the conflict with bacteria and protozoa – aided by techniques which man's acquired wisdom gives him.

Mankind has begun to extricate himself from the struggle for the perpetuation of germ plasm, in which all other species are so completely absorbed. This emergence from the primary biological issue has been achieved through the great development of his cerebral powers, especially those of communication, which has made possible the cumulative assembly of knowledge and technique, and the gathering together of individuals for mutual protection. Not only has man shaken off the marauding carnivores, and to a lesser extent the 'bacteria', but he has begun to alter the environment itself. Forests are turned into arable land, marshes into cities, buffalo into cattle, and yeast into protein. From agriculture to antibiotics, we find man changing the face of the globe, shaping it for his own comfort. But there is much to make us pause.

The discoveries which have lightened the load of human suffering have, until recently, been generally applied only to the few. The emergence of the masses remains precarious. Nor can it be said that man has wholly extricated himself from warring nature. Each problem solved uncovers another, as in the peeling of an onion. The turmoil of living matter is not easily quieted and its power to take charge of our destinies should never be far from our thoughts. Having upset the normal ecological balance, we live more and more in an artificial environment – a world of synthetic diets and values, of drugs and dust from the factories. More recently we have added radiation to the list of man-made hazards, and we know little of the effect which these innovations may have upon the body.

Upsetting the normal interplay of living matter also frees the underlying tendencies of unlimited multiplication and ageing of the population. Biologically, ageing is a backwater in natural selection,[3] and ecologically, over-population is the signal for disaster. If living matter is not to provide its limiting factors, man must find his own answer.

Man has made of human life a sanctity. The value judgment of individual health finds little place in ecology – in which pain is an alarm to warn of danger and the individual is an experiment, an incident in the survival of the race. The pursuit of individual health is for many now an end in itself. This should call for much heart-searching.

Living matter has but one value – survival; man has many. These now obscure the primary goal of living matter; they are raised to an absolute level; in themselves legion, they shade like a spectrum from one opposite to another. Some are social in their impact, and call upon the individual to lead an 'honourable' life in terms of the nation's ethos. Others encourage all kinds of inwardness, from 'genuine' behaviour to the subtle quest for inner harmony. Each has its penalties for transgression, whether estrangement from society or self-division, and modern man is plunged into mental conflict. If the trumpet shall give an uncertain sound, who shall prepare for battle?

Thus, as we cast off the outward trammels of jungle warfare and become free to mould the ideals of our society, we should reconcile our conflicts in a common purpose – the pursuit of the health of mankind. Centrally the problem is one of replacing biological regulation as a means to further the health of the group, by human wisdom. Man, instead of nature, must become our loadstone. To this end, biology needs to be reinforced by social organization; and human wisdom to distil the best from the wide range of human values, and to find a truly human conclusion. This then is the great opportunity for world guidance which the World Health Organization has inherited.

PART TWO

HEALTH AND DISEASE THROUGHOUT THE WORLD

CHAPTER 3

The World's Mantle of Disease

THE picture of health and disease varies almost infinitely throughout the world, so that a complete presentation of it is hardly possible. Even in massive volumes, only the more salient features of its kaleidoscopic patterns are presented. Here it would be idle to attempt any detailed description. Nor, should it be possible, would it necessarily help greatly in our understanding of world public health and its needs.

It is customary to distinguish four zones of the earth's surface – temperate, southern, mediterranean, and tropical. The temperate zone (750 millions) stretches across North America and Europe to Japan and includes Australia and New Zealand; the southern zone (80 millions) is the lower half of South America and the lower segment of Africa, corresponding roughly to the Union of South Africa; the mediterranean zone (370 millions) includes the countries which encircle the Mediterranean basin and the Near East, running out to Siberia, Manchuria, and North-West China. The tropical zone (1,200 millions) includes the south of North America, Central America, and the northern two-thirds of South America, Central Africa, South-East Asia, and the rest of China.[14]

Within this general framework we can examine the distribution of the four main groups into which the diseases of man fall – infections, degenerative diseases, nutritional disorders, and mental illness. These – if they do not cover every entry in the international list of causes of death, disease, and injury – at least help us to understand what problems face public health throughout the world. The outlines are imperfect and detail is lacking. For most of the world, the measurement of disease within each country, according to district, town, or social class, is too imperfect to permit of any true representation (see Chapter 22).

INFECTIOUS DISEASE

The main infectious disorders – parasitic, bacterial, and viral – have been catalogued by country and region, at least in broad outline, so that their distribution and epidemiology is reasonably well known. In order to determine the infections which prevail in say Burma, Paraguay, Japan, or Canada, we need only to turn to *Global Epidemiology* (Simmonds),[11] to the United Nations Demographic Yearbook,[6] or to the World Health Statistics Annual (WHO).[15]

Specific infections are on the whole both more frequent and more severe as we progress from the temperate, through the mediterranean, to the tropical zone. Some of the difference is due to diseases, which, if not prevented like smallpox or typhoid, might prevail everywhere; some depend upon diseases, like trachoma, schistosomiasis, yellow fever, plague, or filariasis, which appear to have what might be called natural habitats. Trachoma has a predilection for the peoples mainly in the mediterranean zone – Spain, Italy, Greece, North Africa, the Near East, Siberia, and North China. Sleeping sickness travels with the tsetse fly. Yellow fever stretches in a broad band across the middle of South America and Africa – ships have taken it, at some time or other, to Bristol and to the eastern shores of North America, but never to India, or other places where it would most naturally be expected to flourish. The schistosomas are limited to Africa, North and South America, and China. Malaria affects Africa, most of Asia, and Central and South America, involving perhaps 700 millions. When plague is represented on the map by small black dots each of 1,000 deaths, the whole of the Indian sub-continent is singled out in a mantle of black.

The temperate zone is not wholly free from infections, nor does it necessarily have less than the rest of the world. Certainly deaths from the specific infections cannot be looked upon as the only guide to an understanding of world distribution of infections. In England and Wales (1962) there were 86,000 (15 per cent) deaths in which infection had played a major rôle, including deaths in infancy and terminal infections among old people; although only 5,000 (0.9 per cent) were caused by notifiable infectious diseases. An even more striking contrast can be seen in the number of persons absent from work as a result of infections. Indeed, infections, if the whole evidence were available, might be found to be more, not less, extensive, when we include the common cold and the virus infec-

tions of the upper respiratory tract, which seem to affect, or affect more seriously, the people of the temperate zone.

Some major infections, among them tuberculosis, are world-wide. Tuberculosis thrives wherever it is introduced to communities living in overcrowded conditions. For long it has been a scourge alike of industrialized countries and of overcrowded eastern cities. Only in recent years has the temperate zone, where the scene of its greatest activity previously occurred, begun to bring tuberculosis under control, shifting the balance to countries like Yugoslavia, Turkey, or Burma in the mediterranean and tropical zones. Between 1950 and 1962 the death rate per hundred thousand from tuberculosis of the respiratory system fell from 58 to 17 in France, from 14 to 3 in Denmark, and from 144 to 33 in Portugal. Tuberculosis is still rife in Japan (27), whereas in Egypt (14.2), Jordan (7), and Nicaragua (7.9) there is relatively little; or else, as is often the case, it is inadequately recorded.

Poliomyelitis, speaking generally, seems to prevail more in the temperate zone – although the variations in different countries, so far unexplained, are very great; in 1949 the cases reported per hundred thousand varied from 413 in Iceland, 37 in Sweden, 28 in U.S.A., 21 in Australia, 14 in England and Wales to 5 in France, 2 in Belgium, 1.6 in the Netherlands, and 1.1. in Yugoslavia.[14]

DEGENERATIVE DISEASE

Cancers in every crevice of the body, and of every type, occur in all peoples. The views which for long prevailed, that there are countries in which cancer is rare or non-existent, and that it is less marked in under-developed countries, is now recognized as false.[10] There is no evidence, for example, that primitive Africans have any lessened liability – rather the contrary;[5] that is to say when adequate consideration has been given to the effects of age. But there are many differences in the prevalent type of cancer in different corners of the world (see p. 42).

The mapping of cancer is still highly imperfect. World maps resemble those of the cartographers who outlined the land masses in the fourteenth century. Apart from the local incidence and prevalence of certain cancers – including industrial forms – there are a few broad generalizations which can be made. The first of these is the remarkable prevalence of hepatic cancer in Africa and South-East Asia. In Indonesia, Java, Sumatra, and among the Bantu miners, hepatomas have been reported as high as 80 per cent of

the total cancers.[1] In Western countries in contrast cancer of the liver is no more than 1–2 per cent.

Second, cancer of the stomach prevails excessively in Japan, a large part of Western Europe, and the north of South America. Nearly half the cancers in Japan are in the stomach. In contrast in South-East Asia from India to New Guinea and in parts of Africa, the relative incidence is very small. Among the Javanese cancer of the stomach may hardly exist at all.

Third, cancers of the bucco-pharyngeal region – although the types vary much – overshadow all else in most parts of India; 40 per cent of all cancers in males are in this region of the digestive tract.[9] This distinction applies probably to most of South-East Asia, North Africa, to the Bantu, and in China and Japan.

Fourth, cancer of the lung, pleura, and bronchi is particularly marked among males in Western Europe, in the U.S.A., and Australia. In Britain it is the chief cause of death from cancer among males. In contrast little or no lung cancer has been reported in Korea, Ceylon, India, Burma, Trinidad, and among the Bantu (Steiner).[12]

Fifth, cancer of the uterine cervix is relatively excessive in India and China, and relatively little-known in Western Europe, the U.S.A., and Australia. There is commonly, but not always, an inverse relationship with the female breast cancer, which, for example, prevails excessively in some parts of Western Europe, in the U.S.A., and in Australia.

NUTRITIONAL DISORDERS

The first world-wide survey of the Food and Agriculture Organization (1946)[7] estimated that more than a third (38.6 per cent) of the world's people immediately before the Second World War consumed less on the average than 2,200 calories per head per day: a third (30.8 per cent) ranged between 2,200 and 2,700; a third (30.6 per cent) had enough (over 2,700). After the war the position was worse; nearly two-thirds took in below 2,200. Many lived, and still do, on a diet of some 1,500 calories, near to the basal metabolic rate.[8] In terms of animal protein, the general picture was even more discouraging. Nearly two-thirds (59.0 per cent) of the world's peoples ate less than 15 grammes daily.By 1963 the calorie content of the diet had regained the pre-war level, but the protein remained grossly defective throughout the under-developed and developing

world, where 60 per cent of households derived more than 80 per cent of their calories from cereals, starch, roots and sugar.[8a]

Dietary surveys of sample groups, which support the results of national averages, have shown that diets in most of the heavily populated regions of the world are defective both in quantity and quality. Where the calorie intake is most deficient the diet suffers from lack of balance, with excess of carbohydrate and too little protein, and is also subjected to wide fluctuations in amount, ranging from starvation to abundance, within relatively short spaces of time.

The areas of greatest deficiency are Central America, most of Asia, and some parts of South America, Africa, and the Middle East. Areas less affected include Southern Europe, three countries of Asia, some parts of Africa, of South America, and of the Middle East. A diet above 2,700 calories appears to be limited to the Western world, the New World, U.S.S.R., and three countries of South America.[8, 8a] Over half of the world's population in the Far East lives on about a quarter of the world's food (made up of 19 per cent of the animal supplies and 44 per cent of the crop food); in Europe, Oceania and North America 29 per cent of the world's population consumes 57 per cent of the world's food (comprising 69 per cent of the animal food and 38 per cent of the crop food).[8b] If the world's population grows at the medium rate postulated by the U.N., in 1975 there will need to be 35 per cent more food merely to sustain the present unsatisfactory diet; for a reasonable improvement 50 per cent more food and 60 per cent more animal products will be needed; in the developing countries the increase in total food may have to reach 80 per cent and of animal foods 120 per cent.[8b]

Among the most serious deficiency states now prevailing in many areas of the world are the protein-calorie deficiency diseases, kwashiorkor and marasmus.[16] Kwashiorkor, a syndrome associated with low protein consumption, affecting chiefly the age group 1-3, abounds throughout tropical countries, aided no doubt by parasitic infestations, and by the infections which destroy the blood and increase the metabolism during fevers. Protein starvation almost certainly aids the onset of cirrhosis, and, in association with wide fluctuations according to season, may play a part in the development of hepatic cancer, which is so prevalent in tropical regions. Yet so little protein is needed to stave off the worst effects of protein starvation. Kwashiorkor, with its retarded growth, depigmentation of the skin and hair, oedema, and liver damage, is absent among the Masai, who eat meat and drink milk; and among peoples, as in

Thailand or Africa, within walking distance of the sea or lakes, who are able to eat fish. Nutritional marasmus, affecting chiefly babies under one, exhibiting extreme muscle wastage, loss of subcutaneous fat and very low body weight, is equally widespread.

Among the rice-eating countries – China, Malaya, Java, Japan – there is widespread disease due to lack of Vitamin B_1; epidemiologically this affects half the total world population, perhaps a thousand million people. Apart from the final manifestation of beri-beri, which is found on a large scale only in South and East Asia, the ill-effects of a diet of polished rice are many and varied; in particular the babies of mothers starved of aneurin die in convulsions, paralysis, or heart failure, so that infant mortality tends to be high. In maize-eating countries – Italy, Spain, Portugal, Africa, Rumania, and Southern U.S.A. – there is pellagra, resulting from deficiency of nicotinic acid, associated with virtual protein starvation. Rickets occurs in Turkey, Yugoslavia, and other countries where infants are denied sunshine without the benefit of a good diet. Keratomalacia, due to avitaminosis A, is most frequent in South-East Asia – paradoxically in the tropical rain belt, where carotene, the precursor of Vitamin A, abounds; in Central Java one to three per cent of pre-school children are said to suffer from acute deficiency with gross scarring of the cornea and blindness together with a high mortality.[3] Iodine deficiency is still widespread (see p. 44); some 5 million persons in India alone may be suffering from goitre associated with cretinism, feeble-mindedness, lowered educational ability, deaf-mutism, thyroid operations, and cancer of the thyroid.[3] Iron deficiency likewise is everywhere common.[16]

These are but the highlights of specific nutritional diseases – the more obvious clinical manifestations of underfeeding. Poor nutrition predisposes to infections, particularly to tuberculosis; and to infestations, such as hookworm. It is perhaps the chief cause of high death rates from preventible diseases, low expectation of life, high mortality in infancy and early childhood, and disasters in childbirth, which afflict the majority of the human race, particularly those living in the tropical and mediterranean zones.

For the Western world – with the lengthening of life that has followed the conquest of infections, an indirect result of technological development, high standards of feeding may have introduced other diseases, particularly diabetes, resulting from a high sugar intake, and the degenerative diseases of the vascular system, which may be related either to too much food in general, or possibly to some one or more articles which have come to play a predominant

rôle in modern diet. The temperate zone tends to suffer, like other parts of the world, from less-well-defined iron and vitamin deficiences in food, which may account in part for widespread secondary anaemias.

MENTAL ILL-HEALTH

Little is known outside the temperate zone about the extent to which mental illness is present in different regions of the world. In the United States more than 550,000 persons are in hospitals for mental diseases; another 130,000 mental defectives are in institutions, and a further 100,000 under supervision – making a rate in all of 5·2 persons with mental disorders per thousand of the population. This can be compared with 5·0 per thousand in the United Kingdom, where half the total hospital beds are occupied by the mentally ill.[2] But smaller numbers in hospital does not necessarily mean a lower incidence. Hospital provision is probably a totally inadequate means of assessing the departures from normal mental health. Many factors have to be taken into account in such comparison. Hospital treatment varies with social customs and community organization. The liability to senile psychosis varies with the age constitution and the proportions of people with degenerative changes in the cerebro-vascular system – over 10,000 new cases of senile psychosis occur annually in the United Kingdom. In many countries mental illness also is absorbed, as it were, within the community without special provision. Most of the mentally handicapped in all communities find a useful place to occupy unobtrusively; but the handicapped are increasingly prejudiced as the life of the industrialized community becomes more complicated.

The differential rates for schizophrenia, manic depression, and psychopathic personalities – and still more hysteria and anxiety – are almost impossible to gauge in the absence of detailed studies, which cannot easily be conducted, for most of the world, without medical and social services. Neurosis has been said to be more prominent in the highly developed world, as an accompaniment of secularization in an industrial society (see p. 127) – absenteeism, psychoneurosis seen in the doctors' surgeries, suicide, divorce, child delinquency, have all been given as examples. The rates for many of these conditions, in countries where reliable statistics are available, vary much; for example, for suicide per 100,000 of the population (1962): Switzerland 18·8, U.S.A. 10·9, Japan 17·6, and Norway 7·9.[15] But it is doubtful whether such a comparison is of any value

without examining the culture of the society in which suicide occurs. The Japanese scene may differ appreciably from that in the U.S.A., and still more from that in Burma or Bolivia.

Most of the phenomena which we use to assess mental health are based on Western values and social patterns, which other countries may not have adopted. In the underdeveloped countries there is much which is of significance to mental health which we have not yet sufficiently studied. The tempo of life, where the drive for material advancement is less, may well be more favourable to mental health. Meditation, which plays an important rôle in Burmese life, and the absorbing ritual of religion as in Bali – in their present form and as they change with 'development' – are likely to be of the very greatest significance. When there are so many unknowns, we should withhold judgment upon mental health until measurements can be devised and epidemiological research undertaken.

CHAPTER 4

The Developed and Under-developed Worlds

IN the last chapter disease was seen to be distributed in a very varying pattern throughout the world. Here we see how much the world's picture depends on socio-economic considerations. In very general terms, the health of every country depends upon its state of development; by contrasting the picture presented by two representative groups of countries in different states of development we can see, at least in its major considerations, what differences exist.

The world has been developing new ways of living ever since man was able to live in settled communities, if not before. But 'development' which is accompanied by social and technological changes affecting everything in the lives of the people, from the homes they live in to the chemicals they manufacture to protect them from major infections, was speeded up considerably in Europe some time in the middle of the seventeenth century; it became much faster when industrialization began a century later (see Chapter 13), and it has now spread so widely that every country in the world has been affected, in varying degree.

Development affects health and disease both favourably and

unfavourably; favourably, by more or less unconscious changes in living standards, in diet, habits, housing, communications, literacy, social developments, etc., as well as by a conscious growth of public health designed to overcome particular hazards; unfavourably, by changes in the age structure of the population, by adverse aspects of industrialization (for example, smoke pollution), or by the acquisition of new harmful habits (for example, smoking).

Most people in developing countries live in villages where life, with a traditional organization and a hierarchical control, tends to be moulded by long-standing custom. The family, often extended, is a strong binding force. Life on the farm, and simple handicraft skills, in which men, women, and children take part, are based upon the home. Town living is limited to a few large cities. Such communities depend mainly upon agriculture, with as much as 80 per cent of peasant subsistence farming. Husbandry uses hand methods, lacks fertilizers or any of the advantages of scientific practices, and makes poor use of manpower, as indicated by the large number (over 100) workers to the square mile of agricultural land; in contrast there is no mechanization – as indicated by the small number of tractors. Few manufacturing industries exist, so that whatever manufactured goods are available have to be imported, and little use is made of energy from coal, water, or petroleum. Capital and capitalized equipment are lacking, transportation systems are primitive, and inadequate use is made of the country's raw materials Income per head, and as a percentage of world income, is low; so too is the level of literacy and of services of all kinds – financial, organizational, professional, social – which ultimately depend upon it.

The peoples of these countries are subject in varying degree to uncontrolled hazards of famine, flood, and pestilence, so that the high birth rates are counter-balanced by high death rates, often with wide fluctuations. Diet is at, or below, 2,000 calories per head per day. The high infant and child mortalities, and a low expectation of life, leads to a characteristic population structure.

The picture presented by the developed world is the mirror image of the under-developed world. Famine, flood, and pestilence no longer occur; agriculture is generally second to industry; agricultural methods are highly mechanized; and great use is made of scientific disciplines, including plant genetics. The number of agriculturists per square mile is low (around 30), the tractor is greatly in evidence (U.K., one to 57 arable acres), and farming is of a type designed to sell its products in the markets of the world,

and not solely to keep the farmer and his family. The average diet is near to, or above, 3,000 calories per person per day. Great use is made of coal, water, and petroleum for power. Capital and capital equipment, transport, development of raw materials, income per head and as a percentage of the world income, literacy, and services of all kinds are at a high level.

The most characteristic sign of development is that of town living (see p. 103). Most of Europe has more than 50 per cent of town dwellers (Britain, E. & W., 80·7, Denmark 67·3, Sweden 56·3, and Norway 50·5) as compared with the countries of the East, South America, or Africa, where urbanization is less than 40 per cent (Egypt 30, Nigeria 8·5, Guatemala 31·6, Burma 10·4, Ceylon 15·4).[13] An urban life differs from that in the village by being more impersonal. Individuals and families tend to be more separated from the kin group, and social organization in the form of traditional and local groupings is less in evidence. Women are economically employed to a less extent, and in work of a different kind which takes them away from the home.

The developed countries have much lower birth and death rates. In a group of 25 (in and around 1950) where town living exceeded 50 per cent, 12 had crude general death rates below 10 per thousand in contrast with 4 only out of 29 where urbanization was below 40 per cent.[13] In the case of infant mortality 15 out of 24 countries with more than 50 per cent town dwellers had a rate below 50 per thousand live births – as compared with 4 only out of 30 countries, where urbanization was less than 40 per cent.

The statistics of countries with few doctors and poor recording systems are incomplete. The developing world records less than 90 per cent of essential data for vital statistics, and is affected by irregularity of registration. This can be seen in the certification of deaths from senility – 14 per cent of total deaths in the developing world are certified as due to senility compared with 1 per cent in the developed world (see Fig. 5). Since countries are able to give analysable statistics only when they themselves are already substantially affected by development, it follows that the picture presented by the developing world must be less favourable than would be the case with some other countries, which are unable to provide adequate records. With this reservation the statistics of the United Nations registry should in general present a fair comparison. The United Nations Demographic Yearbook (1964) shows marked differences between the two halves of the world in employment, natality, mortality and demography.

*Employment**

Striking differences exist in the nature of employment and in the extent to which women work outside the home. In the developing world, as represented by the Congo, the majority of workers are in agriculture (Fig. 10); whereas in the developed world, as represented by the U.S.A., employment in agriculture is less than in both manufacture and services and no more than equal to that in commence (Fig. 11). In the Congo, women constitute approximately half the working population; whereas in the U.S.A. they represent only about one third (Figs. 8, 9 and 12). The much higher proportions of women 'economically active' in the developing world is seen as a function of agriculture in which women act as unpaid family workers (Fig. 10).

Economic employment comes earlier in the developing world. Thus the proportions of the total males and females employed at the lower ages is much greater, and the reverse at higher ages. The developing world also employs a higher proportion of children.

One effect of this pattern of employment is to cause the pyramid of employed population in the under-developed world (Fig. 9) to resemble the population pyramid, each age group having the same proportion of total persons and total employed.

Deaths

The pattern of deaths in age groups also differs markedly in the two types of country. That in the developed world (Fig. 1) shows the characteristic of a 'senescence curve'. From a relatively small mortality in younger years (excluding infancy), the percentage in each age group rises slowly to middle life, and then bulges out to a maximum at between 65 and 75 years of age. Most people live long enough for declining resistance, a biological event, to make itself apparent in a rapidly increasing death rate amongst later age groups. The life of man can, on the whole, be predicted.

The pattern of the under-developed world approaches that of a 'non-senescing' population, i.e., one in which a fixed proportion will die in a unit of time.[4] After an enormous infant mortality, the percentage of deaths at each age group remains roughly constant to 85 and over (Fig. 2), much as occurs with some creatures in the wild state, or with a set of restaurant tumblers, where the risk of

* Comparability of economic activity is not easy to obtain owing to variable interpretation of what this means. The Congo has been used as an example of those countries recording 'unpaid family workers'.

fracture is constant. In such a population, expectation of life is the same roughly at all times, i.e. year by year.

Women die earlier in the under-developed than their sisters in the developed world. Thus the proportion of female deaths in most age groups is much nearer to that of males until after 75 when, in both types of country, the proportion of female deaths must exceed the male in the natural course of disposing of excess. The distinction is particularly marked at age 25–34, when female deaths in the developing world are nearly equal to male. Many factors, favourable and unfavourable, must tend to alter the sickness rates in the two sexes; but the sum of the effects of environmental factors in the under-developed world is clearly more adverse to women. The harshness of the environment, seen in the non-senescing curve of deaths (Fig. 2), equal participation with men in economic activity (Fig. 8), and the greater hazards of more frequent childbirth, between 15 and 45 years, will each contribute.

A high proportion of people in the under-developed world die in early childhood. Thus the proportion of deaths occurring under five years of age is 27 per cent, compared with less than 4 per cent in the developed world. The comparison can be made with Europe a century ago, when England and Wales had 40 per cent of deaths under five years.

The balance of advantage is certainly with the developed countries, but the end-result of such varying factors gives rise to a widely differing pattern in different regions, countries, and even districts. An example of this is the deaths from accidents which are dependent upon habits of driving, the state of industry, and the increase in old people; the results of this interaction produce an accident mortality per 100,000 as high as 107 in England and Wales and as low as 34 in Denmark.

Births

The birth rate in the developed world, 23 per thousand, is that of countries which have reached the low stationary phase on the demographic curve (see Chapter 8); the rate in the developing world, 42 per thousand, at or near the biological maximum, is that of countries in the high stationary, or early expanding, stage.

The low birth rate, together with a small infant mortality, reduces the strain of childbearing in terms of effective population production. One million women in five countries of the developing world in 1954 gave birth to 224,433 babies, of which 194,238 were alive at

the end of one year, and 164,606 at the end of five years. One million women in five countries of the developed world gave birth to 136,032 babies, of which 132,437 were alive at the end of a year, and 131,867 at the end of five years. Thus with about 60 per cent of the gestations, the developed world after five years had achieved 80 per cent of population increase in the under-developed world.

The proportion of babies born to women in each group during the childbearing period reflects clearly the biological fertility of women in general, since it remains roughly similar in the two types of country (Fig. 4), despite the prevalence of artificial limitation in the one and its general absence in the other. Thus in successive five-year age groups from 15 to 45 the proportions are: Under-developed, 10, 30, 29, 19, 9, 2½; Developed, 10, 27, 29, 17, 11, 1½. The proportion of women of childbearing age, which is higher in the developed world at every age group from 15 to 45 (see Figs. 5 and 6), has to be taken into account.

The Population Pyramid

In the under-developed world (Fig. 6), the population pyramid is broadly based, with a nearly uniform decline in numbers from childhood years until extreme old age. In the developed world (Fig. 5), the pyramid has a narrower base with nearly uniform age groups from 5–14 up to 35–44. The proportions in the upper age groups gradually approximate in both types of country until, at 85 and over, they are approximately equal.

The proportion of persons over 65 years in the developed world in 1963/4 was 9·6 per cent as compared with 2·5 per cent in Indonesia (1961); at ages over 75 years, 3·5 per cent as compared with 0·8 per cent. Where the process of ageing has gone further, this disparity is even greater; in England and Wales and France (1963) and France (1962) the figure for men and women together was 12 per cent over 65 years of age. Both types of country have an excess of females over males in the higher age groups. The balance of old people with other age groups, particularly those under 15 years, differs greatly. Of 1,000 individuals in the developed countries, 260 were under 15 years of age, and 85 over 65 years – as compared with 355 and 25. The two groups of countries can be compared again with Europe in the mid-nineteenth century and today. Thus in 1841 in England and Wales out of every 1,000 persons 361 were children and 44 over 65 years of age; whereas in 1963, 226 were children and 120 over 65 years of age.

Causes of Death

There is a striking difference in the actual and relative numbers dying from different diseases (see Fig. 7). Thus in the developed world, containing approximately 281 million people in the years about 1962, 26 persons died from typhoid and paratyphoid fevers in comparison with 4,106 in the developing world which had a third of the population (approximately 98 millions). Conditions of an infective or probably infective origin (1954) caused 11·6 per cent of the total deaths in the developed world as compared with 45 per cent of those in the developing world. Communicable disease in the developing world represents 11 per cent as compared with 1 per cent in the developed world; gastrointestinal disease represented 20 per cent as compared with 4 per cent; respiratory disease 15 per cent as compared with 5 per cent. Tuberculosis distinguishes itself by being approximately equal as a cause of death in both types of country, although much more probably goes undetected in the developing world.

Fig. 7 shows also the extent to which deaths from chronic degenerative diseases differ in the two sets of countries. Thus in the developed world deaths from diseases of the heart and circulatory system, intracranial lesions, and cancer accounted for 66 per cent of the total as compared with 8 per cent in the under-developed world. Atheroma accounted for a third of the deaths in developed countries.

The inadequacy of comparisons based on births and deaths is only too obvious. They give little information about disease as distinct from death, and they virtually ignore the mental aspect of the world's health problems – deficiencies which cannot be glossed over. If our attention could be focused more upon disease and less on death, we might see greater resemblances between the two types of countries, since the distribution of many of the less lethal virus diseases, and much that occurs in the psychiatric and psychological fields, may well be less dissimilar. Yet the picture presented is sufficiently arresting to call for further examination. Death is final and irrevocable – and of course generally extreme – but it arises out of disease. A high mortality must also mean a high morbidity, although the opposite is not necessarily true.

Until relatively recent times, the health picture, at least in general terms of sickness if not of precise diseases, was more uniform than it is today. The immediate effect of development has been to produce a wider disparity. This is but a temporary phase, for the achievements of one part of the world will be the goal of all. It is to public

health that we must look for sound guidance, so that the good is copied and the harm avoided.

The techniques which public health must apply in seeking to remedy the conditions resulting in ill-health in both developed and under-developed countries are of course many and varied, and beyond the scope of this book. But in successful public health we are involved not only in technology, but also in philosophical, anthropological, organizational, social, and economic considerations which determine the success or failure of technical procedures. It is with these wider issues – ecology, town living, occupation, industrialization, food, family life, hospitals, geography and climate, population, and beliefs and customs – that the next nine chapters will be concerned.

Figs. 1–7 are based on data in the Demographic Yearbook (1954), comparing five highly developed countries (Australia, Great Britain, Canada, Denmark, U.S.A.) with five developing countries (Ceylon, Colombia, Egypt, Guatemala, Mexico).

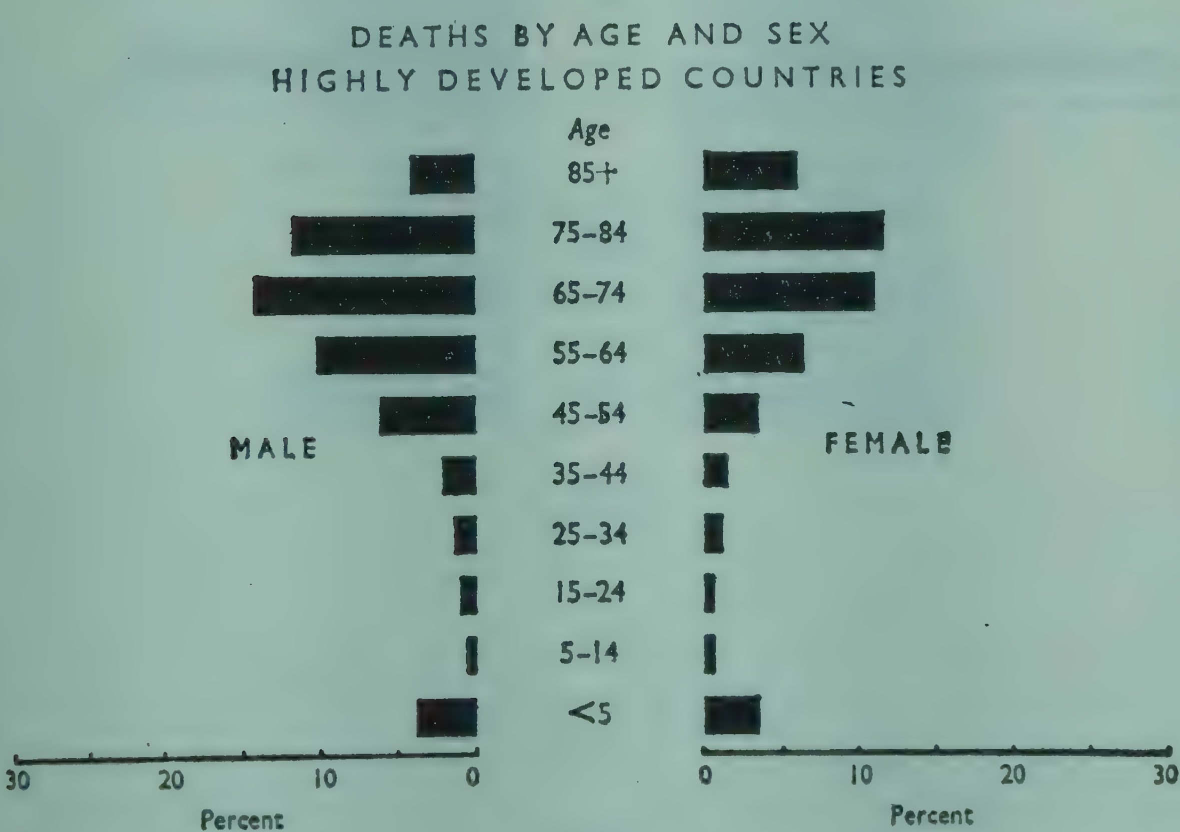


Fig. 1

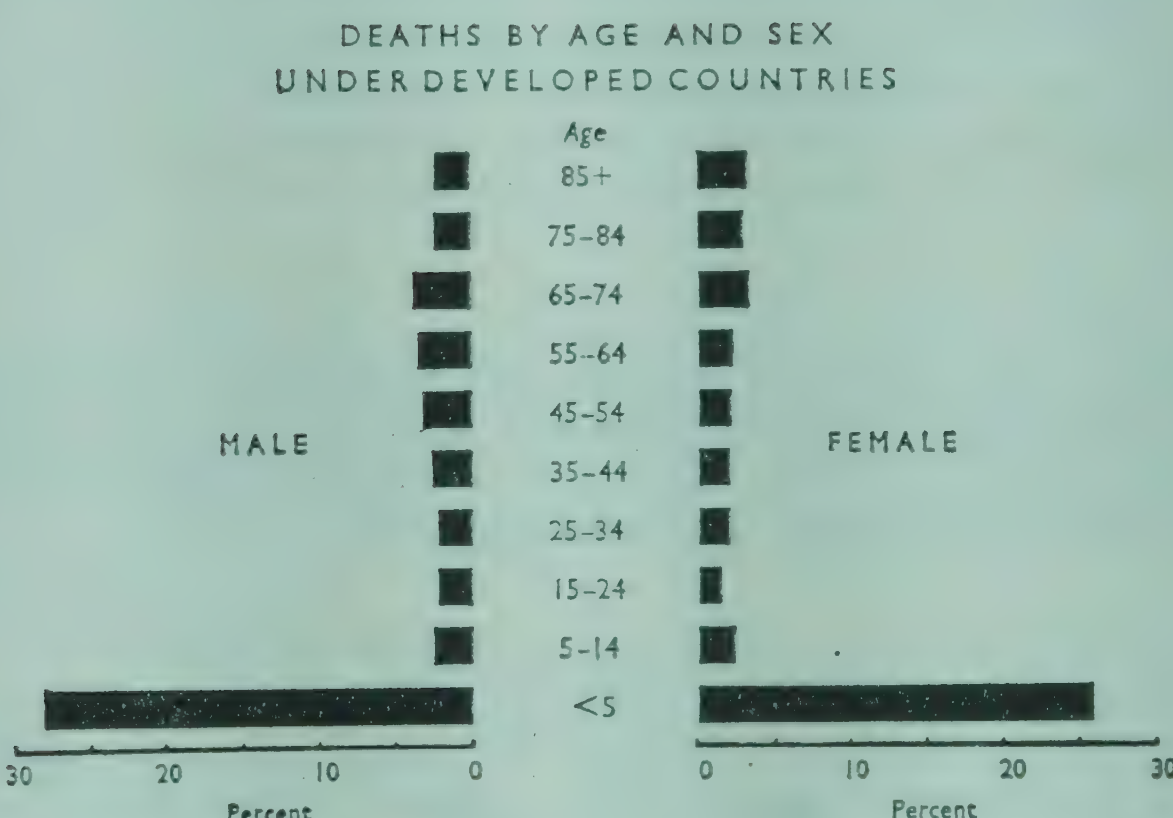

DEATHS BY AGE AND SEX
UNDER DEVELOPED COUNTRIES
Age
85+
75–84
65–74
55–64
45–54
35–44
25–34
15–24
5–14
<5
MALE
FEMALE
30 20 10 0
0 10 20 30
Percent
Percent

Fig. 2

DEATHS

RATIO MALE/FEMALE

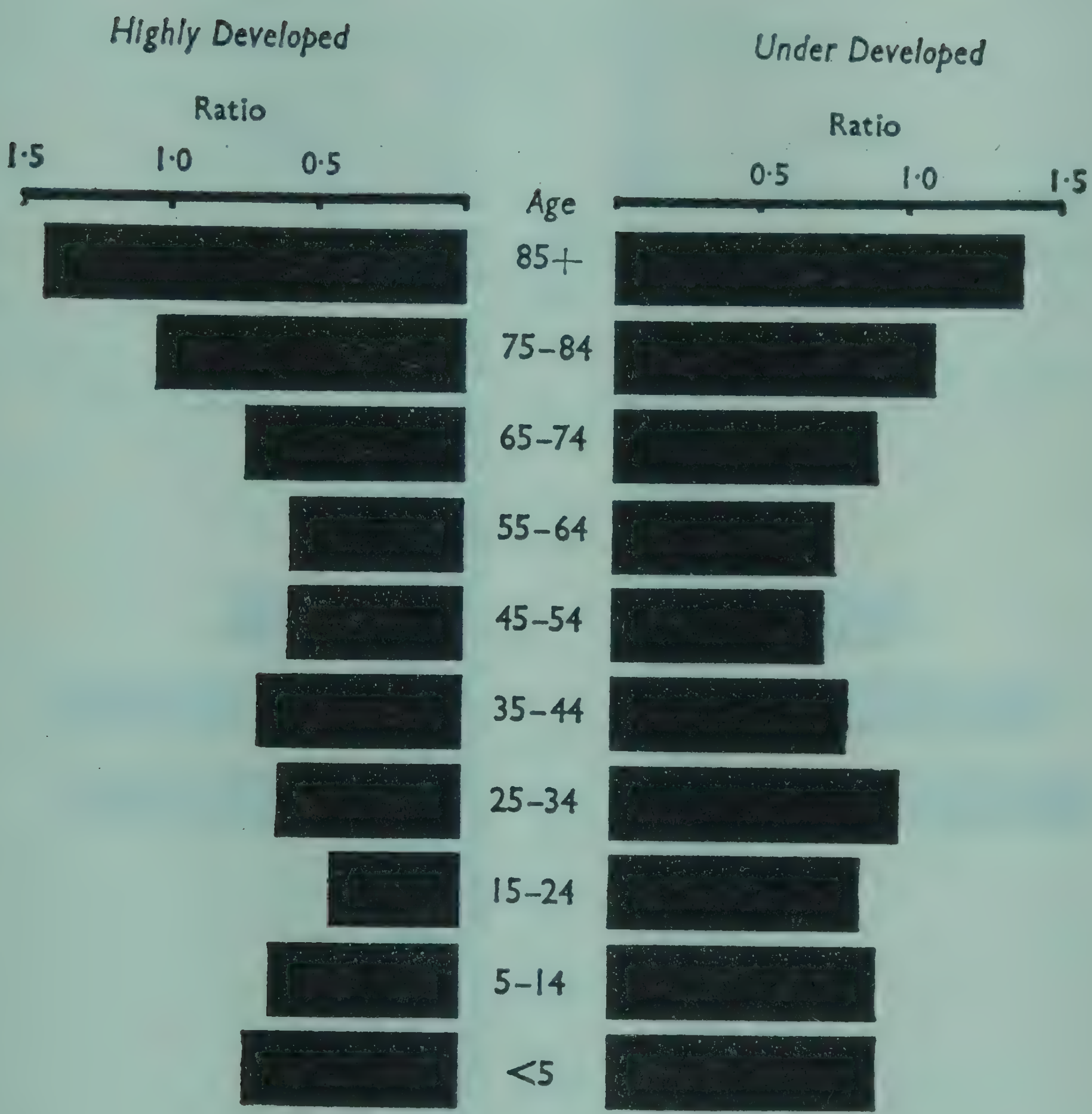


Fig. 3

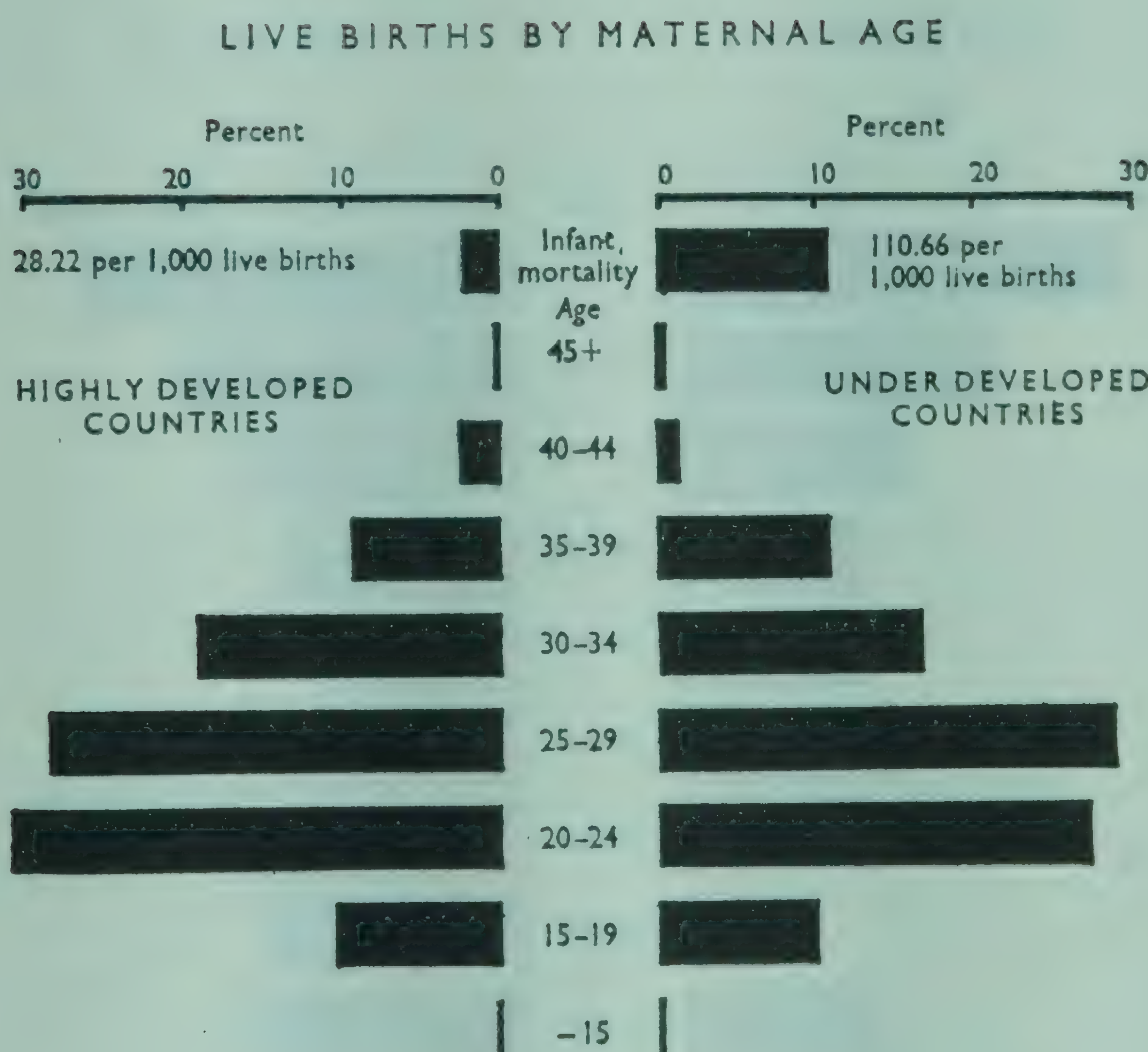

LIVE BIRTHS BY MATERNAL AGE
Percent
30 20 10 0
Percent
0 10 20 30
28.22 per 1,000 live births
Infant, mortality
110.66 per 1,000 live births
Age
45+
HIGHLY DEVELOPED COUNTRIES
UNDER DEVELOPED COUNTRIES
40–44
35–39
30–34
25–29
20–24
15–19
–15

Fig. 4

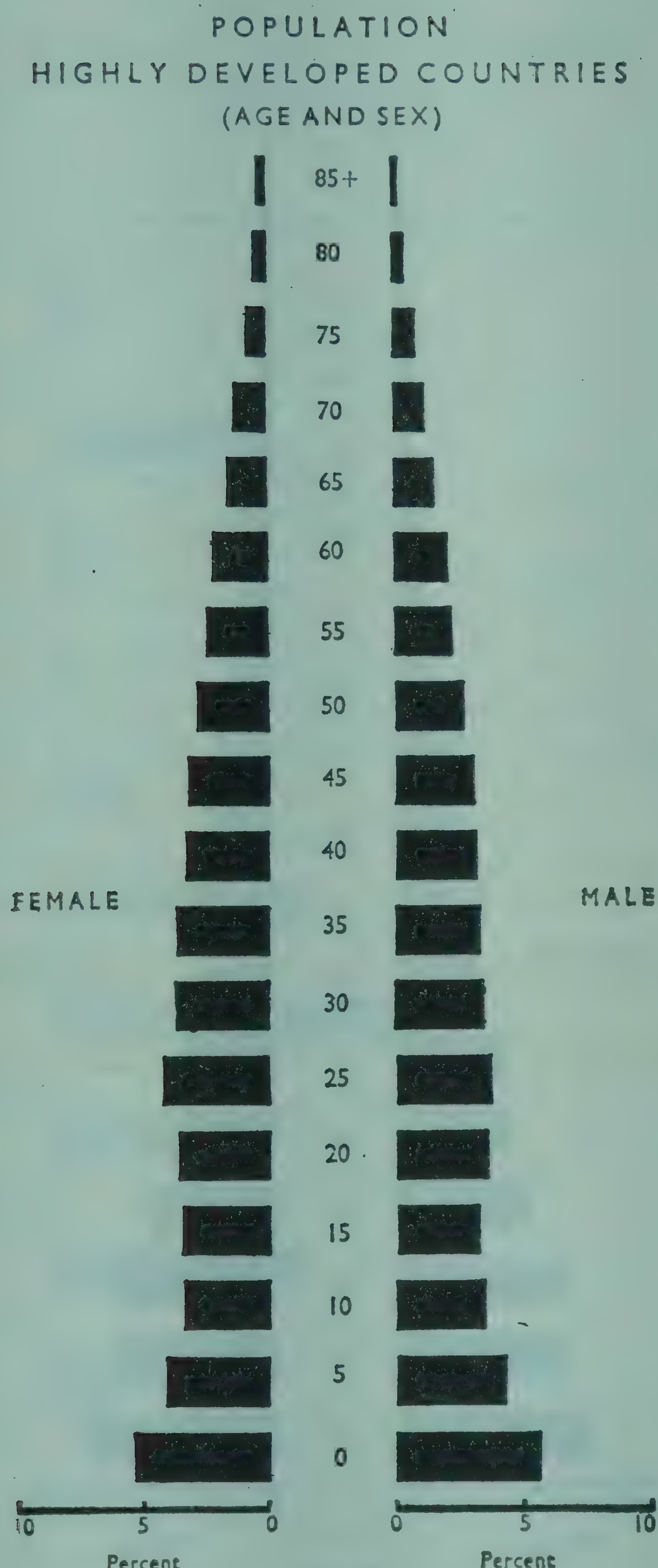

POPULATION
HIGHLY DEVELOPED COUNTRIES
(AGE AND SEX)
85+
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
FEMALE
MALE
10
5
0
0
5
10
Percent
Percent

Fig. 5

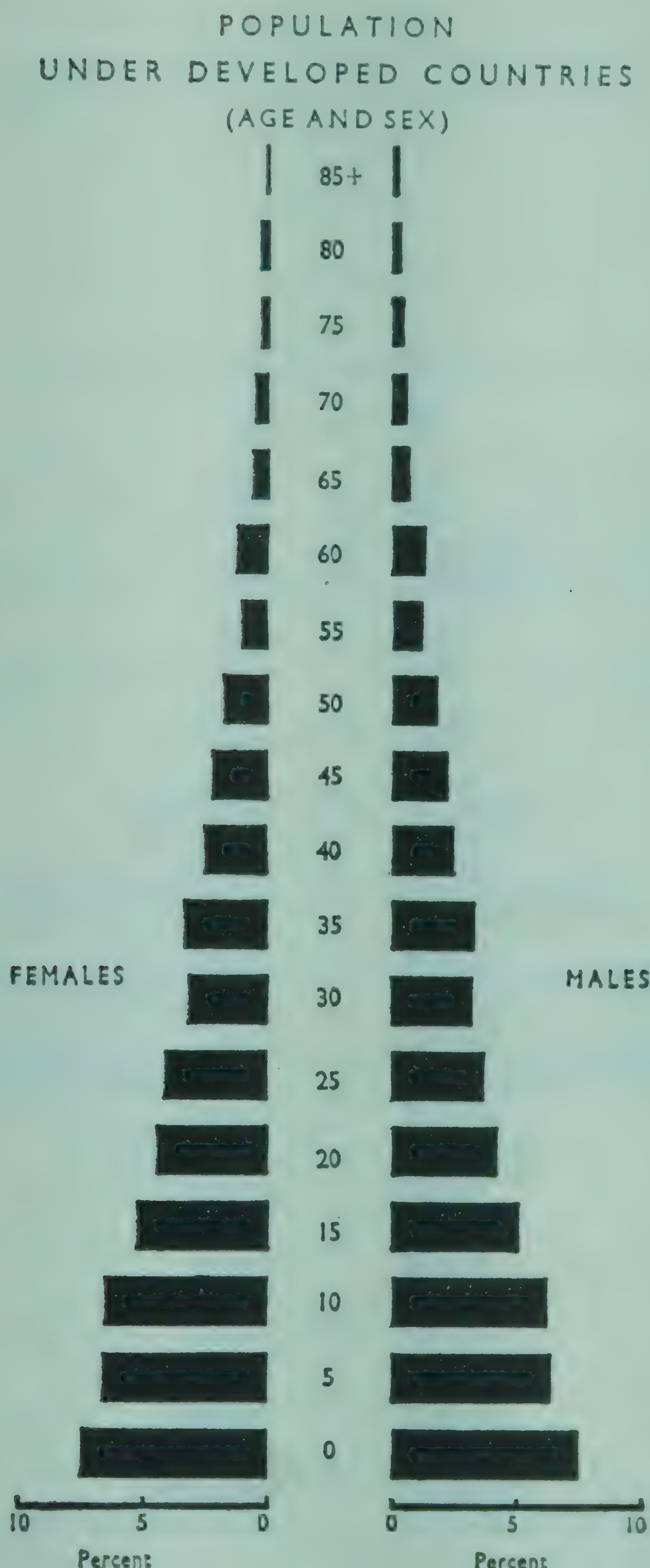

POPULATION
UNDER DEVELOPED COUNTRIES
(AGE AND SEX)
85+
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
FEMALES
MALES
10
5
0
Percent
0
5
10
Percent

Fig. 6

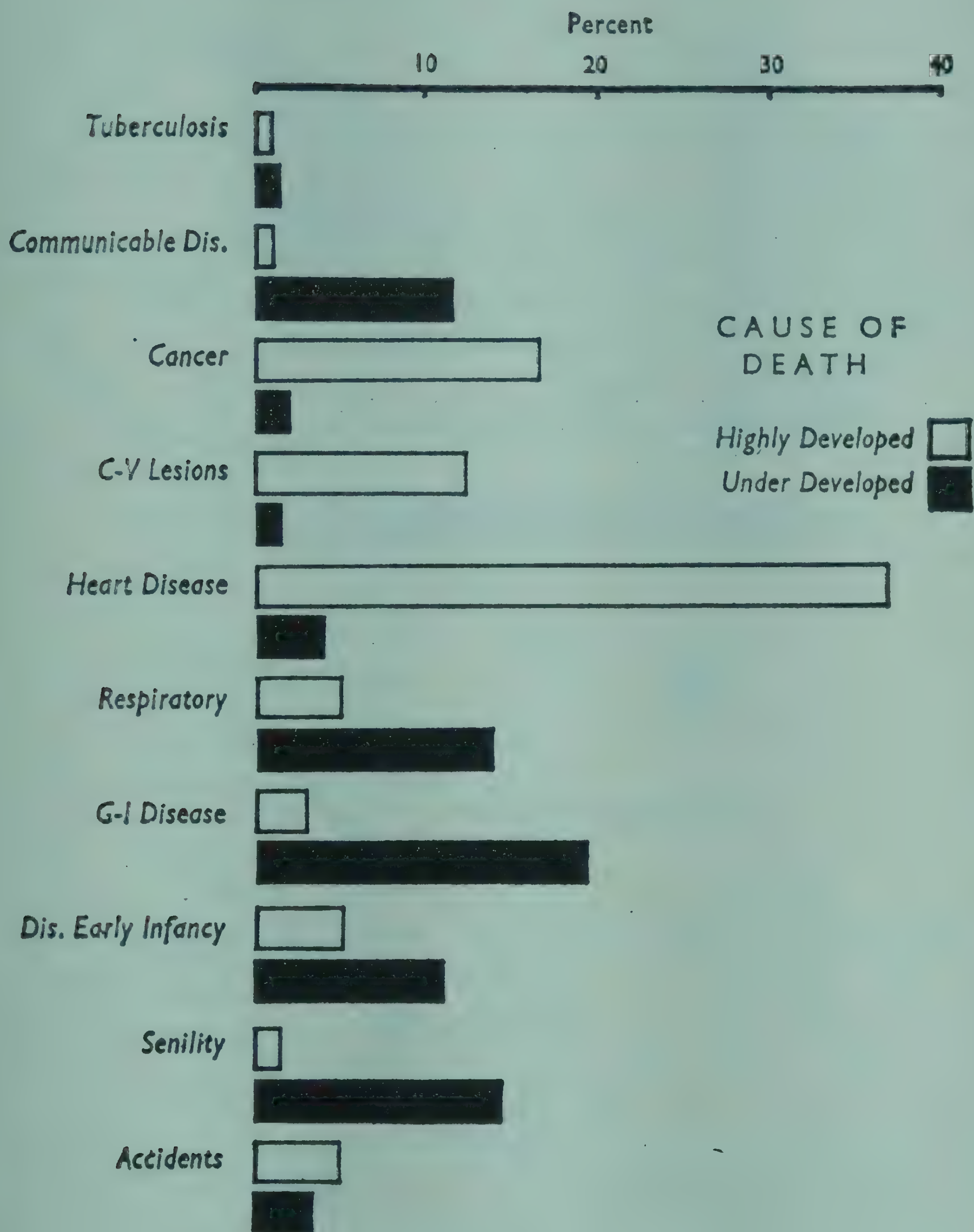

Percent
10
20
30
40
Tuberculosis
Communicable Dis.
Cancer
C-V Lesions
Heart Disease
Respiratory
G-I Disease
Dis. Early Infancy
Senility
Accidents
CAUSE OF DEATH
Highly Developed
Under Developed

Fig. 7

Figs. 8–12 are based on data from the Demographic Yearbook (1964) comparing the Republic of the Congo with the United States of America.

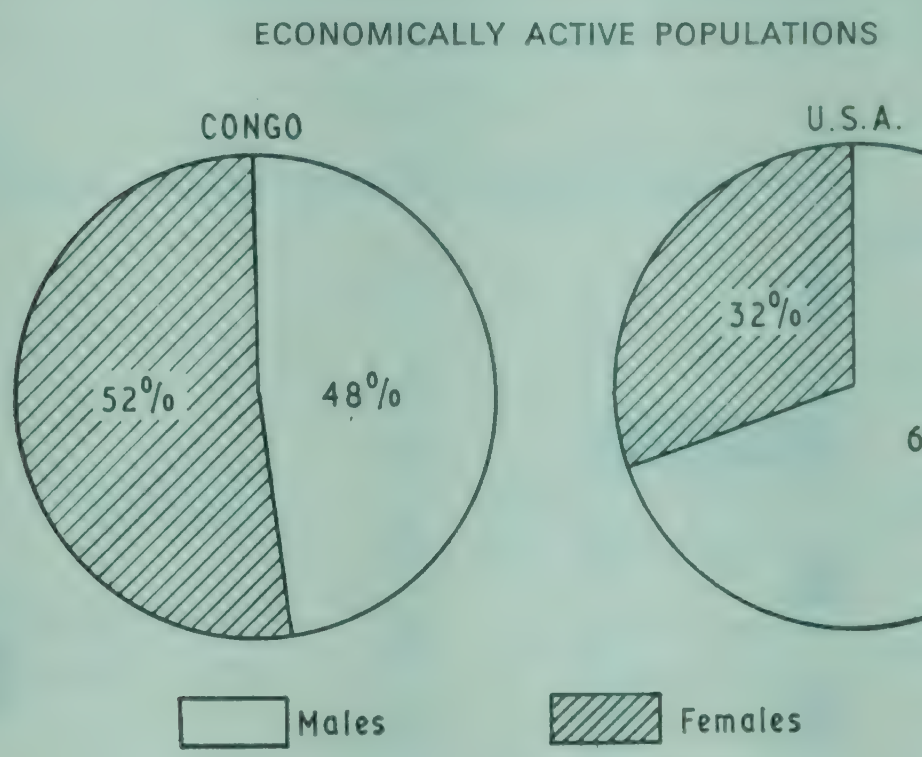


Fig. 8

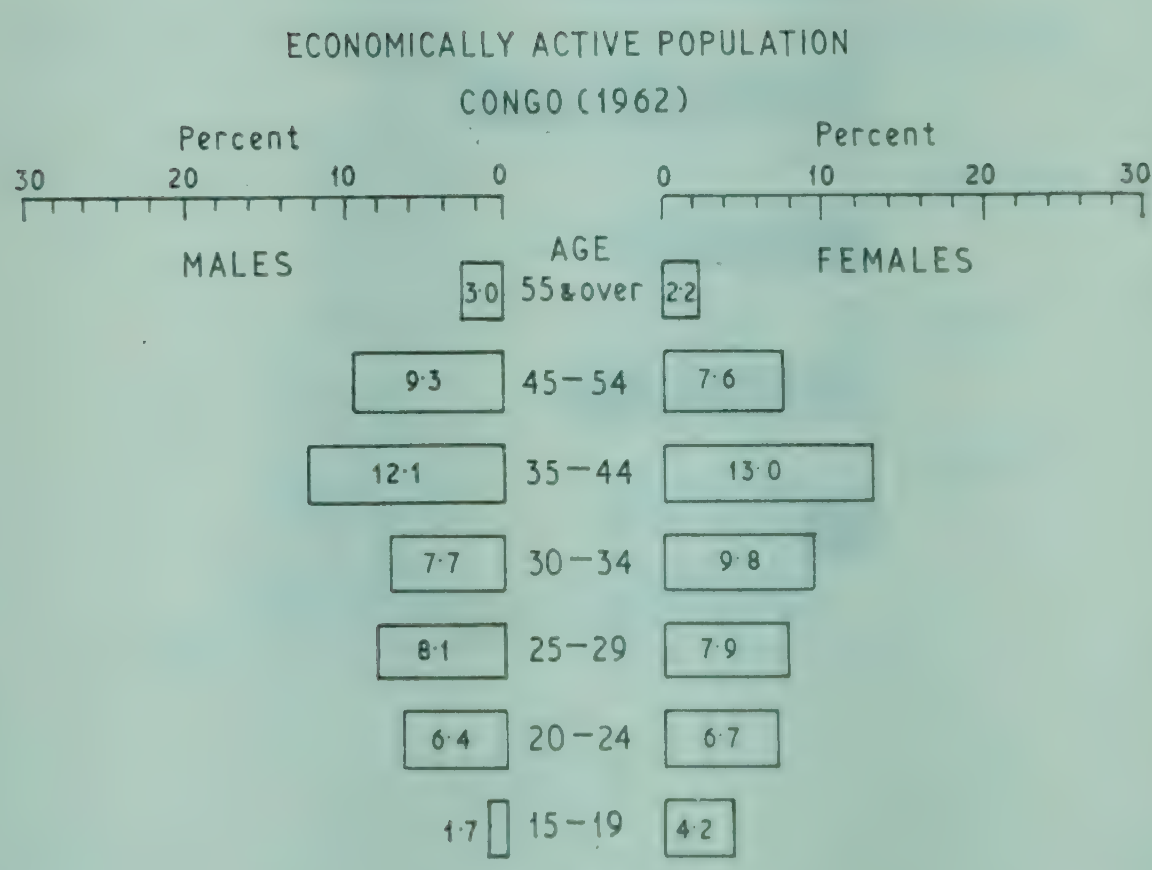


Fig. 9

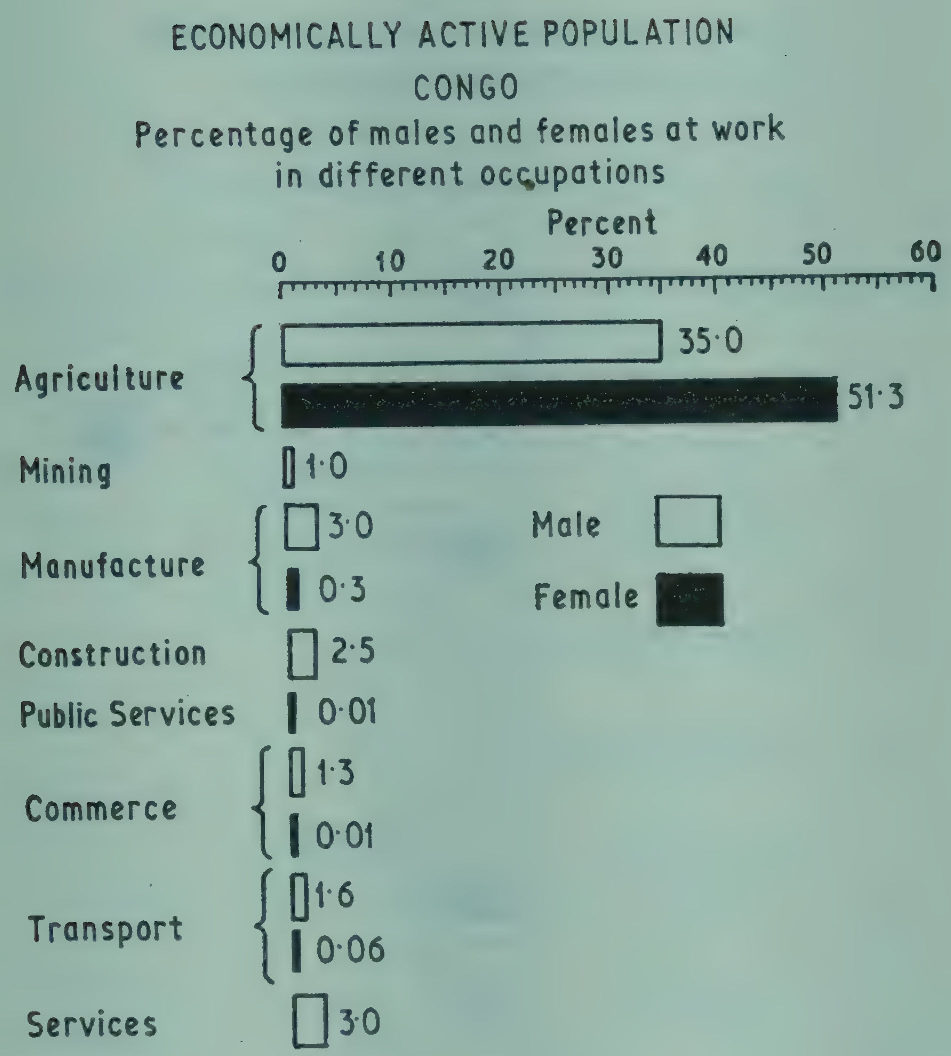

ECONOMICALLY ACTIVE POPULATION
CONGO
Percentage of males and females at work
in different occupations
Percent
0
10
20
30
40
50
60
Agriculture
35·0
51·3
Mining
1·0
Manufacture
3·0
0·3
Construction
2·5
Public Services
0·01
Commerce
1·3
0·01
Transport
1·6
0·06
Services
3·0
Male
Female

Fig. 10

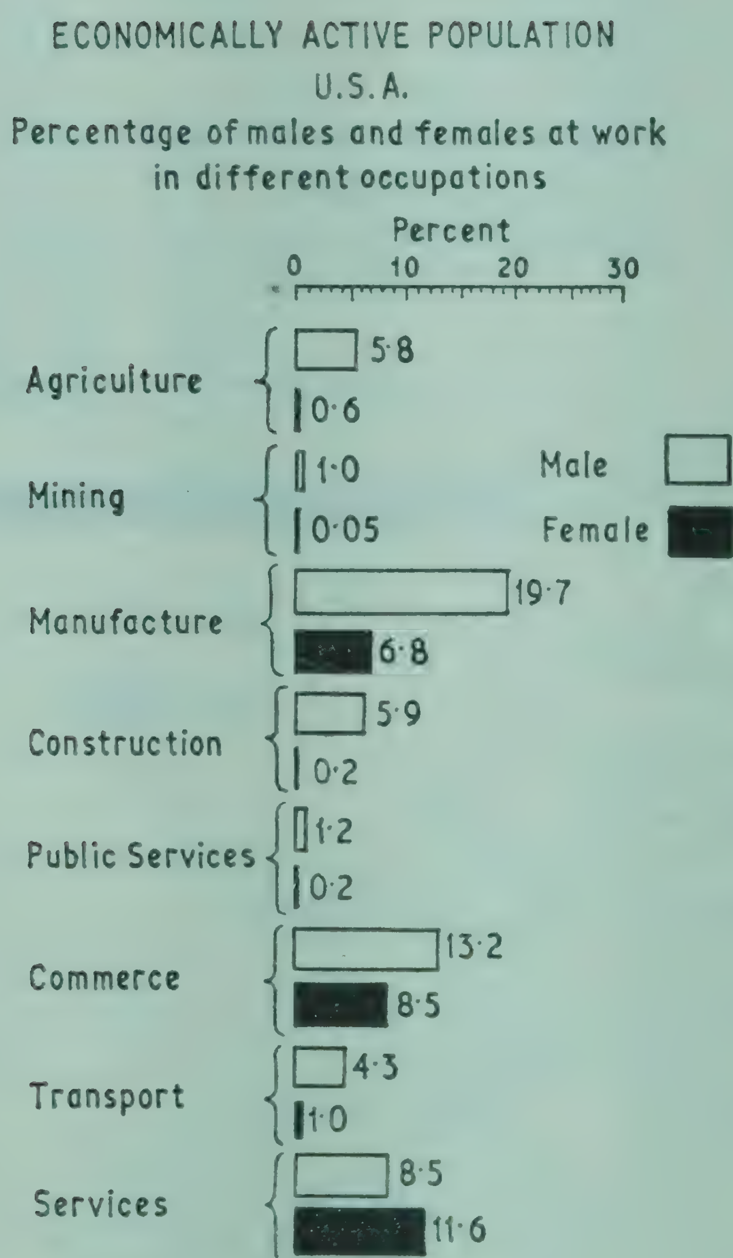

ECONOMICALLY ACTIVE POPULATION
U.S.A.
Percentage of males and females at work
in different occupations
Percent
0
10
20
30
Agriculture
5·8
0·6
Mining
1·0
0·05
Male
Female
Manufacture
19·7
6·8
Construction
5·9
0·2
Public Services
1·2
0·2
Commerce
13·2
8·5
Transport
4·3
1·0
Services
8·5
11·6

Fig. 11

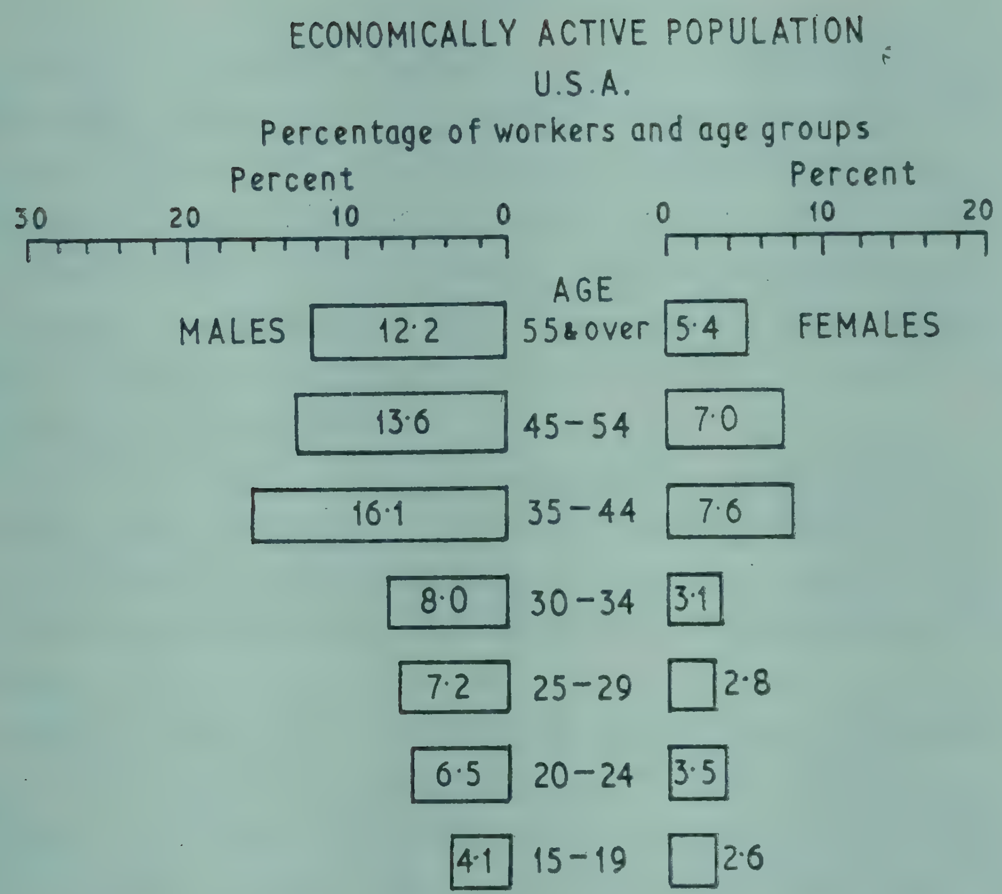

ECONOMICALLY ACTIVE POPULATION
U.S.A.
Percentage of workers and age groups
Percent
30
20
10
0
Percent
0
10
20
AGE
MALES
FEMALES
12·2
55 & over
5·4
13·6
45–54
7·0
16·1
35–44
7·6
8·0
30–34
3·1
7·2
25–29
2·8
6·5
20–24
3·5
4·1
15–19
2·6

Fig. 12

PART THREE

THE PURSUIT OF HEALTH

CHAPTER 5

Geography

THE pursuit of health through the environment has fascinated medical writers ever since Hippocrates first described the effects of 'airs, waters, places'.[2] For 4,000 years, climate and season in relation to health and disease have been studied assiduously and commented upon voluminously. Geographical factors, or 'geogens', cover the whole gamut of influences that bear upon man's welfare – social, biological, physical – although it is not always easy to distinguish one category from another.

Socially, the human being makes his own geogens, by population distribution and density, communications, beliefs and customs, habits of living, industrialization, occupation, and by the environment which he shapes for his daily life – housing, diet, clothing, and sanitation.

Biologically, man is an incident in an ecological episode, in which disease is the result of aggression by other animal or vegetable organisms, or where ill-health results from tissue changes – some reversible, others irreversible – which are independent of other forms of life. The effective agents of disease, animal or vegetable organisms, can be introduced to the body *directly*, as with cholera, typhoid, or tuberculosis, by inhalation, ingestion, or through wounds – or *indirectly*, as with malaria, by means of a vector (carrier). For many, as for worms, an intermediary host is needed for the development of a larval stage; man may himself be the intermediary host. In some instances, as with plague, animals are the main habitat of the infection and man's involvement an incident.

Physically, the earth's surface is important for health – if we exclude height above sea level – mainly on account of the nature of the soil and because of the climate – temperature, barometric pressure, wind, sunshine and cloud, rainfall, humidity, and latitude. The geographical patterns, and endemic foci, where specific diseases

more or less regularly prevail,[3] and the variations within countries, districts, and classes are, as we have seen (Chapter 4), generally related most directly to social or biological, rather than physical, geogens.

SOCIAL AND BIOLOGICAL GEOGENS

Infectious Disease as an Ecological Phenomenon

Many diseases may be thought of as an episode in ecology – expressions of strife between different creations of nucleoprotein engaged in the pursuit of food gathering. Thus, when ill with syphilis, tuberculosis, or poliomyelitis, man is an episode in the life of the bacterial world. Infection is a widespread manifestation of duels between species – all animals and plants suffer from infectious disease; even the bacterium succumbs to bacteriophage.

Infection is of great importance to the animal world when there is a glut, or when drought or bad weather causes a massing of animals at the water pools, or in places of shelter. Botulism, and *Pasteurella multocida*, massacre the ducks in summer droughts, when as many as three million at a time have been counted dead on the shores of the Great Salt Lake.[4] But infectious disease is more important to human beings than it is to animals in the wild, since man, having escaped from other distempers and predation, lives long enough to succumb, or to reach a stage of overcrowding great enough to promote the spread of disease.

The human body is well equipped to meet the invasion of parasites as they occur. Defence mechanisms of various types exist. These can be interpreted, within the general ecological scheme, as devices for maintaining the integrity of one combination of nucleoprotein against the encroachment of another – the phagocytes (or amoeboid cells), the specific antibodies, bactericidal chemicals in the body fluids, and the inflammatory reaction which mobilizes the defences at the site of danger. The importance of these defences is thrown into relief by the plight of those who suffer from a partial lack of them. The patient with agranulocytosis may die because of his depleted store of phagocytes and the patient with agammaglobulinaemia because of his lack of immune bodies – despite support from the antibiotics, which man has recently enlisted.

Infectious disease is an ecological cul-de-sac – of advantage to neither species. The burden of all life is to survive, so that it is never in the interest of the parasite to kill his host which provides his living. The association of man and parasite tends, therefore, to follow a set course. A new disease due to an obligate pathogen

makes its entry with a fierce epidemic, killing many, especially in the young adult age group. Gradually in the course of evolution, it seems, man and the parasite adapt themselves to each other, possibly moulding a mutually harmless or even beneficial relationship. Syphilis, now relatively mild, was, in the fifteenth century, when it came to the virgin soil of Europe from North America, an ulcerating pestilence, rapidly fatal. Measles, endemic to the greater part of the world, decimated in the early nineteenth century the islands of the South Pacific. Thus, in the twentieth century, man finds himself at various stages of adaptation and compromise with the obligate pathogens of the bacterial world.

But man has many associations with the bacterial world which could be described as peaceful, if not friendly, co-existence. Many of these organisms assist the body, manufacturing vitamins, for example, Vitamin B_{12} and other members of the B group, in the gut, and helping to digest the food and to keep out infection. The lactobacilli in the adult vagina ferment sugars and make an acid environment inimical to pathogenic organisms. Many other bacteria are harmless inhabitants of the human frame: the nose and throat harbours many harmless inhabitants – diphtheroids, *Streptococcus viridans*, neisseria, fungi, spirochaetes, fusiform bacilli, haemophilus; the gut has a bacterial flora so extensive that 50 per cent of the faeces is composed of bacterial protoplasm.

The existence of the truly potent pathogen is precarious. The addition of a single scientific weapon of defence is often enough to turn the scale. Smallpox and cholera, in many parts of the world, have been annihilated by simple remedies. Tuberculosis, in the developed world, is being extirpated, with a combination of science and social organization. The resistance is greater where the organism has second lines of defence upon which to retire; thus, plague kills man rapidly, but can continue in the rat, among whose numbers it smoulders, only occasionally irrupting into society; typhoid, quickly perishing in the acute phase of the 'disease', entrenches itself in the kidney and gall bladder, whence it can pass, for years, to the urine and faeces. Tuberculosis has owed its long success partly to resistance to the physical environment, and partly to the chronic nature of its processes which have aided dissemination.

Much therefore that we see in the world's picture of disease is directly the result of man's failure to break the chain of causation. Insect transmission, in malaria or filariasis, for example, accounts for an enormous loss of life and debilitating illness. The whole of malnutrition is, in the last resort, preventible; so that the hundreds

of millions who live in malnourishment, as well as the millions who have specific nutritional diseases, are suffering from man's failure to make an adequate adjustment between his social, biological, or physical geogens. Infection and malnutrition go hand in hand round one of the many vicious circles of which disease is the focal point.

The chief tropical infections – smallpox, plague, cholera, relapsing fever, leprosy, hookworm, etc. – prevail, in the last resort, only because tropical peoples have not yet organized their lives in such a way that the chain of causation is broken; all have at some time, within the extraordinary and often inexplicable epidemic process, been distributed widely throughout the world. Smallpox, which prevails in Africa, Asia, and South America, was one of the commonest diseases of the whole world during the eighteenth century. As late as 1754, a tenth of all mankind was crippled or disfigured by it,[10] and fifty years ago it was still widespread. Throughout the middle of the nineteenth century, outbreaks of cholera caused a heavy mortality in England and, in the view of many, were the real reason for progress in public health organization.

Diarrhoea and enteritis,* which takes a heavy toll in the mediterranean and tropical zones, where, for example, in Egypt it is responsible for over a third of all deaths, and in Greece, Portugal, and Chile for 8–10 per cent, as well as a large part of infant mortality, is the result mainly of polluted water supplies and defective food hygiene.[11] The same story could be told of Europe until well into the nineteenth century. Until fifty years ago it was one of the most dangerous ailments of children under two years, accounting in some countries for over half the deaths. Today less than ½ per cent of total deaths within the Western orbit can be ascribed to it. The differences between the developed and under-developed worlds are often mainly due to control in the disposal of human waste. Many hold that the greatest single factor in world disease today is the common habit of indiscriminate defaecation. The manuring of land with uncomposted human waste also handicaps greatly, particularly through the spread of worms.

The effect of public health can be seen reflected in the mortality from the four common ailments of children – whooping cough, diphtheria, measles, and scarlet fever. Taking the four together, mortality per 100,000 in 1961/2 was as follows: Netherlands 0·2, United States 0·3, Switzerland 0·3, England and Wales 0·4, Canada 0·6, France 0·8, Italy 1·4, Portugal 4·6, Mexico 33.·8, Chile 39·0 and Guatemala 147.[11]

* B 36 in International Abridged List 1955.

Degenerative Diseases

As man emerges from the primordial ecological arena his disease pattern changes. A higher proportion of his community lives to older ages (see p. 29). Ageing may be defined as 'an increased liability to dying under the ordinary stresses of life'; but we are left to ask ourselves whether there is such a thing as ageing in itself, or whether every manifestation of it can be attributed to a process we normally call disease. Grandfather seems to be running down like a clock, but what is the underlying cause of his stiffness, asthenia, short-windedness, and loss of memory? Is it widespread intrinsic degeneration of his connective tissue, with an impaired capacity for repair? Or is it the hardening of his arteries, or chronic bronchitis and emphysema? The answer is not clear, but let us make a critical distinction: an intrinsic change in the vitality of the body cells, such as their capacity to multiply, or the hormonal environment in which they live, we will call ageing; a change caused by interferences from outside, we will call disease, even when this operates indirectly, as by lessening the supply of blood to essential organs by damaging the blood vessels. On this analysis, it seems unlikely that anyone dies purely from old age; disease is always a heavy ingredient, but clearly disease of a different kind from the ecological competition of nucleoprotein, which we have described above. It is not due to competition; it comes in late and slowly and does not involve the defence mechanisms.

Much of man's morbidity and mortality is now caused by degenerative diseases – atheroma, chronic bronchitis, high blood pressure – due it would seem to new ways of living, or to old ways now given a chance to produce long-term effects. Degenerative disease – the result of chemical, neurological, or even bacterial disturbances – may have its roots in the man-made geogens of modern life – stresses, diet, pollution of the air, and habits. It may also at least in part be the result of intrinsic processes in the germ plasm – the effects of genes, acting in the post-reproductive period of life, when the guns of selection are more difficult to bring to bear.[7]

Atheroma, due to the deposition of cholesterol and other fats under the lining of the larger arteries, is probably the end-result of several mechanisms, including the formation of small blood clots on the walls of arteries in response to repeated injuries and stresses, and the consumption of too much and the wrong sort of fat. Chronic bronchitis progressing to emphysema and congestive heart failure is a slow destruction of lung tissue, the victim of repeated insults from

mild infections, dust, tobacco smoke, and fumes from the factory ovens. High blood pressure, which contributes to atheroma, and to the deaths from cerebral vascular disease, although little understood, is almost certainly due to noxious influences related to man's environment.

We do not know the cause of cancer, but the more we learn about 'the nearer causes' (Rous), the clearer it becomes that the main differences which occur in its relative incidence depend upon exogenous factors – chemical substances, radiation, infections, diet, sunlight – with long-continued provocation. Such factors themselves depend upon habits rather than upon matters intrinsically related to the physical and climatic character of the earth's surface – diet, sunlight, and smoking; the Kangri warmer held next to the skin, or the excessive use of red Chili peppers in the food; the eggs of bilharzia in the bladder, and a hundred other seemingly harmless episodes, may be playing a role in the production of different cancers. Circumcision is probably, directly or indirectly, associated with a lower incidence of cancer in the cervix and vice versa. Cancer of the cervix is incompatible with virginity; and it increases with declining economic standards.

In the great majority of human cancers the aetiological agent is not known. Hepatic cancer is likely to be related in some unexplained way to diet – possibly to deficient protein or to frequent fluctuations in its intake, or to one or other of the spices most used in Africa and Asia; so too is gastric carcinoma, where the amount and character of the fat consumed, or the method of its cooking, may be the chief consideration in South-East Asia, if not in Japan. Cancers of the bucco-pharyngeal region are likely to be related in some way to the habits of tobacco chewing and such customs as chutta smoking, where the lighted end of the cigar is within the mouth – although the method of curing tobacco may well be invoked to explain discrepancies, such as the absence of cheek cancer in Indonesia. Some small amount of cancer depends on industrial practices. Chimney sweeps, workers in gas, tar, pitch, or creosote, and fishermen, get cancer of the scrotum through contact with soot and oil; aniline dye workers get cancer of the bladder; and 50 per cent of Joachimstal miners die of cancer of the lung, due to inhalation of radioactive gases. Much exposure to radiation gives rise to leukaemia. Cancer in the form of 'sarcomata' has also been experimentally produced in animals by virus infection – since Rous first filtered sarcoma in the Plymouth Rock Fowl (1910).

But behind the immediate causes of cancer, something even more

fundamental can be dimly seen – something we may call a failure of ecology. Living species exist at the expense of one another, but on the whole they remain loyal to themselves – so too in the individual, dozens of organs and millions of cells remain controlled in the general interest of the germ plasm. Each cell, capable of rapid division, as seen in tissue culture, is held in check by some sensitive system of signals. Cancer cells no longer obey the signals. The germ plasm has lost its grip. Chemicals, radiation, body hormones, viruses, destructive genes, non-specific inflammatory agents, have produced an irreversible change in the cell proteins, and set the stage for a miniature evolutionary process which ends in the cancer cell.

The enormous incidence of cardio-vascular disease in the temperate zone and the great excess of cancer – apart from its variations – is the result of the ageing of the population. In most countries the annual incidence of cancer per 100,000 population increases from about 100 cases at age 40 to 150 at age 50; thereafter it doubles in each decade to reach 1,200 at age 80.[9] In countries with a relatively young population – as for example Africa, where only 10 per cent are over 40 years of age – the incidence of cancer must be lower than in countries with greater proportions of old people. Inadequate diagnosis and reporting, themselves dependent on lack of medical and statistical services, play an even more important rôle than with infectious diseases. The calculation of absolute incidence and prevalence is generally not possible, and the usual method of comparison is still that of relative incidence, as a proportion of post-mortem findings or of hospital cases.

Degenerative disease, when represented as black dots of 1,000 deaths, envelops the continent of Europe and North America in a pall every bit as black as that of plague in India – although it may mean less to the community because it occurs in middle and later years, whereas plague kills young and old alike. India will exchange, in time, her mantle of plague and other infections for that of degenerative disease, unless, before then, the causes of degeneration have been discovered. The same forms of cancer may not be developed to excess, for much will depend upon the retention of old habits and the acquisition of new ones. If India – or any other tropical country – takes on the same pattern of cigarette smoking and pollution of the atmosphere with industrial waste, it is likely to follow England in the sharp spiral of deaths from carcinoma of the lung. The increase in mortality of lung cancer in Japan suggests that the spiral there has already begun. Burma, like the U.S.A., may

abandon the cigar for the cigarette to her disadvantage. If, however, the near causes of cancer can be sufficiently determined, health education may be able to steer newcomers to public health away from dangerous habits.

PHYSICAL GEOGENS

But when all possible weight has been attached to social and biological factors, there remains much evidence for regarding physical geogens as of great importance to health, so that people who live in different regions and districts and under varying climates may be specially favoured or prejudiced. The physical characteristics of the globe, and its climate, must in the last resort have determined man's welfare and shaped his progress. By forming the soil, and indirectly controlling animal and vegetable life, they will have supplied him with the basic essentials of life, including clothing and food. By their responsibility ultimately for his diet, they will have determined his health, his propagation, and his civilization. The monsoons have favoured rice growing; the trade-winds have taken merchants and adventurers across the oceans, carrying incidentally the seeds of new vegetation from one part of the globe to another, and of old diseases to new habitats.

The cloudy atmosphere of the northern hemisphere, which keeps out the sunshine, must be counted as a sinner in depriving northern peoples of sun-made vitamin D, thus accounting for rickets which was an endemic condition of the temperate zone until cod liver oil and artificial vitamins were available. Both chronic bronchitis and carcinoma of the lung in Britain are, in some measure, due to the atmospheric conditions, which hold down the smoke and turn mist into 'smog'. Where cloudless skies prevail such disabilities hardly occur; but in contrast fair skins without pigmentation have an added liability to skin cancer. Rheumatism has long been related to damp and cold, with what precise mechanism we no longer claim to know.

Lack of trace elements in the soil does not apparently cause man, unlike animals and plants, much obvious harm.[1] Neither the cachexia and anaemia (pining), which is seen in ruminants on lands deficient in cobalt, nor the paralysis (swayback) of sheep, where soil content of copper is low, occur in man. Plants suffer in various ways from lack of boron, manganese, and zinc, but man rides above these difficulties of metabolism. Yet he is handicapped by lack of iodine in the mountainous regions of Switzerland, the Balkans, the Asian plateau, the Rockies, and Himalayas, particularly when living on

older geologic formations or on sedimentations (see p. 16). Iron and copper deficiencies, which show themselves as anaemia, particularly in the temperate zone, may well also be determined by the soil.

The physical character of the soil or sub-soil also affects the ease with which water-borne infections occur, and it helps or hinders 'worm' transmission. Thus the soiling of land and waterways is a more serious matter in some parts than others. Hookworm is inhibited by dryness, so that in countries such as Egypt the soiling of land with human faeces is less likely to cause its spread; whereas a lightly moist soil, as in Thailand, Java, or Southern U.S.A., favours it. The chalky Dinaric Alps in Yugoslavia, once soiling of the surface land occurs, favour pollution of the wells. Excessive hydatid disease along the Dalmatian coast, and the Aegean shores of Turkey, may also partly depend upon this fact. The eggs of the worm *Taenia echinococcus*, which dogs excrete in large quantities, more easily gain access to man, and so give rise to the secondary stage of development as cysts in his liver and elsewhere. A similar phenomenon may account, according to one theory, for the relative freedom of Holland, Finland, and Yugoslavia from paralytic poliomyelitis – if, owing to the network of waterways, or to the porous character of the sub-soil, the virus is able to gain access to water supplies, and to immunize, by repeated sub-clinical doses without paralysis, in early childhood.

What effect climate has upon bacterial pathogenicity is unknown; but it is by no means certain that it is negligible. Amoebae, which devastate the East with abscesses in the liver and elsewhere, can be found in the gut of a high proportion of Westerners. Why do they not give rise to the same ill effects? Climate may account for the remarkable phenomenon of endemic cholera in India – for it is from India, over many centuries, that waves of infection spread across the world. Perhaps India provides the ideal conditions for the survival of the delicate 'vibrio' outside the human body – low-lying lands and lakes, rich in organic matter and salts, sheltered from rain and sun.[6] Trachoma, resulting in much blindness – one of the oldest diseases known to man – has been called a disease of poverty and promiscuity; but this hardly seems sufficient to account for its relatively limited distribution in the mediterranean zone. It is not impossible that a climatic factor favours its propagation.

Temperature and humidity, the state of vegetation, and the abundance or otherwise of animal life, affect the vectors of disease, and so in turn the many members of the bacterial world which depend upon them to complete their life cycle, or otherwise to

propagate themselves. Thus the mosquitoes, which carry malaria, yellow fever, dengue, encephalitis in many forms, filariasis, and other diseases, are affected, and their disease-carrying qualities altered, by a great variety of climatic conditions. The snails which are the intermediary hosts for schistosoma may find living conditions more to their taste in the waterways of Egypt than in those of Bangkok, or they may never have succeeded in finding transport for the long sea journey which intervenes. The African slaves, who took schistosoma to the New World, must have carried both 'haematobium' and 'mansoni'; and yet today haematobium – the typical bilharzia of Egypt – is hardly to be found in South America, where possibly the conditions for the intermediary host may have been less favourable. Similar influences may affect many other carriers, determining perhaps, at least in part, the distribution of malaria, yellow fever, and filariasis. Flies (African trypanosomiasis), ticks (Rocky Mountain Spotted Fever), and mites (Scrub typhus) are all sensitive to climatic changes. And so, too, the rat may have found better living in India, and in turn have helped the bacillus of plague to maintain itself – so that when the great epidemics of plague slaughter him, the myriads of fleas could more easily transfer to man. The reason that plague occurs mainly in the rainy season is probably that the rat remains indoors, where, with the seasonal lowering of temperature and humidity to aid their propagation, the fleas increase in numbers.

Finally man's reaction to his environment – his output of work, his mental alertness, and his desire for change, and possibly many other attitudes and responses – may ultimately depend upon the meteorological conditions in which he spends his waking and sleeping hours. Both external and internal conditions are of importance. One basic need is for a measure of comfort – particularly in the home. Until the Greeks perfected the hypocaust, or hot-air system for internal heating of houses, all earlier civilizations were developed at or near to the 70° F isotherm. Moreover when Greece and Rome vanished, and the hypocaust with them, civilization returned temporarily with the Arabs to the same isotherm level.[5]

Yet it is certain that the more stimulating external conditions of the Northern climate, given good house comfort, have played a part in man's development. A mean temperature of 40° F in winter and 60° F in summer, with a relative humidity of about 60 per cent at noon, and high enough at night to precipitate dew, is the most stimulating for mind and body.[3] An area of *very high energy* runs through North-East and North-Central United States and North-

West and Central Europe. A zone of *high energy* covers the remainder of the United States, except the deep South and the rest of Europe, excepting Southern Spain and Portugal and some sparsely populated northern parts of Scandinavia; it projects eastward into Russia to the borders of Siberia, and includes Japan. Few can doubt that energy takes its place among the complex factors upon which the health picture of the world depends and which this book sets out to examine. Much future progress may depend upon the use of technology, by air conditioning or other means, to create the conditions of maximum human energy output throughout the less favoured regions.

Public health with its modern armamentarium for speedy action against man's biological geogens is perhaps in danger of overlooking the influence of more long-term factors. Both the social geogens, of which much will be said in subsequent chapters, and the physical geogens, need to be closely studied. To be successful public health needs a balanced approach – in which social, biological, and physical geogens, and their many interactions, are under continuous pressure.

CHAPTER 6

Beliefs and Customs

SCIENCE AND SUPERSTITION

THE great majority of the human race early lose their curiosity about the happenings of their daily lives. The doctrine of Claude Bernard, 'to be of good faith and do not believe', is not usually easy to practise. For the ordinary mortal – if not for Abelard, Voltaire, or doubting Thomas – it is easier to accept the reasons for the phenomena which we daily encounter when these are given by those we respect than it is to doubt and discuss. Superstitious beliefs, therefore, abound throughout the world. In the developed world where there is a scientific background, superstitious beliefs may pass unnoticed; the myriads of bacteria may be identified with evil spirits – even if the aseptic ritual is adopted. Religious ritual may differ little in its superstitious content and less in its psychotherapeutic qualities from the Ghost Dances.[1] Science itself may

play the rôle of magic and scientific routine can take on the character of rituals, so that in scientific societies, magic in the form of science has been made respectable; science has become the Sacred Cow. The greatest handicap of workers of one culture in the setting of another is their failure to appreciate the complexities of their own beliefs and the lack of objectivity which they themselves display.

The main difference between the magical beliefs held by different cultures can perhaps be looked upon as one of degree or of depth. The men and women of the Western world who still believe in luck, charms, talismans, and horoscopes do so a little apologetically.

Beliefs in the under-developed world, except the more recent accretions, have little connexion with science. The biology of infection in particular is quite unappreciated. Too often dressers, trained to boil instruments, have been known afterwards to wipe them on filthy rags; midwives, after swabbing their hands for an aseptic delivery, have run them through their hair. It is never safe to assume that people who wash will do so when hygienically it is most needed. Thus, in Indian villages one may bathe before a meal, but fail to wash the hands before attending to a childbirth. In this, the under-developed is perhaps less removed from the developed world than might at first appear. Water is regarded by most people as clean if it has no visible impurity or smell. Many who have taught first aid in Europe, for example to factory workers, will have realized how slight is the general understanding of the germ theory: the idea that bacteria can be undetectable except by laboratory techniques, and that they have a life of their own in competition with man, is not easy to grasp.

Customs and beliefs take on incongruous patterns to outside eyes. Variations seem endless; some are practical, many apparently useless: some do good, others harm; some are deeply rooted, others of little consequence. Odd or curious as they often are, they all fit into the matrix of the culture. To understand them, and the psychological and social functions which they perform, we need to explore deeply. Health practices are based upon beliefs which penetrate into politics, philosophy, etiquette, religion, cosmology, and kinship.

Causation of disease

The concept of disease in the under-developed world falls, in very general terms, into three categories: conditions for which a cause has been empirically determined; those due to magic; and

the psychological phenomena.[8] Natural diseases of which the cause has been ascribed include those due to cold air or to violations of hot and cold prohibitions. The commonly understood magical diseases in South America are due to 'Evil eye' (*ojo*), or to 'fright' (*susto*). Those due to psychological causes, in Peru for example, are shame (*chucaque*), disillusion (*tiricia*), anger (*colerina*), and jealousy (*caisa*).

In aetiology and in treatment the Hippocratic concept of disease can be detected in different guises. In its simplest form it postulates the existence of a balance of the four cardinal humours – blood, phlegm, black bile, and yellow bile – themselves endowed with elementary qualities, hot, moist, dry, and cold. Thus, in South America, to which the Spaniards brought Arab concepts of medicine, pneumonia is a cold disease and typhoid hot. The corresponding hot and cold food vary in each village of Latin America. In Xochimilco, for example, the hot foods include: sugar, honey, green Chile pepper, and brandy, while cold foods include rice, meat, most fruit, and vegetables.[8] Galen's philosophy of disease as a lack of harmony with the universe can also be seen at work in many societies, where good thoughts, avoidance of quarrelling or aggressive acts are thought to maintain good relations with the universe, and, in consequence, disease is regarded as a punishment for sin, mainly against society.

Theories of contagion, generally far removed from our own, are firmly held. In Mexico, varying diseases, for example smallpox, venereal disease, and measles, are accepted as contagious, but chicken pox and tuberculosis are generally not.[8] Some regard intercourse during menstruation as a cause of veneral disease; among the Kgatla intercourse with a man with 'hot blood' engenders a condition known as 'hot hips'.[18] The agents of infection, and its routes, may differ widely. Excrement may be dangerous, but only when it comes into contact with another's excreta.[18]

Magic is commonly involved, both as a cause and a cure of disease.[7] Fears, expectations, and beliefs surround menstruation, childbirth, sexual relations, excretory processes, and foods. Thus a menstruating nurse in hospital can endanger a male patient. Excreta can give power for evil; many have told stories of the pathologist examining specimens of stools while the donors look anxiously on to see the material safely buried. Latrines in many places are regarded as dangerous, since sorcerers may collect faeces there (Uganda).[18] It may be safer to defaecate in a mountain stream (New Guinea).[18] Pregnant women can be dangerous to the com-

munity and must follow stringent regulations. The birth often has to take place according to tradition, sometimes in a special dwelling or in a special position – squatting, kneeling, or bearing down on a rope slung from the ceiling. The placenta may have to be buried under the house floor, because to put it elsewhere might blight the land (Kgatla);[18] or in contrast, where unity with the earth is strongly held, it must be buried under the appropriate tree or rock to maintain continuity. In Colombia it must be buried in hot ashes if the mother is to avoid pain. In rural parts of Japan it must be kept, if that of a female child, until marriage. Disposal of the lochial blood often causes anxiety because of the evil it may cause. Such magical beliefs are not fixed and immutable but capable of change.

Every known society has developed methods of preventing and treating disease. Most societies, today, have a mixed assortment of empirical, scientific, and magical remedies in their medicine chests. In a cholera outbreak in Yunnan, taboos, prayer meetings, placatory rites, injections, and hospital treatment were all tried.[6] Of the empirical remedies many are objectively effective: baths, massage, cauterization, splinting of fractures, inoculations against smallpox and snake bite, and an enormous pharmacopoeia which includes opium, quinine, and digitalis. Others without any obvious benefits, and often attended by harm, would no doubt have been found in Europe until recent times, and some persist today, including herbal remedies, the 'hot' and 'cold' qualities of foods, and strange poultices. The evil eye was believed in Europe to be a cause of illness, certainly in the thirteenth century and probably much later. The poultice of a live pigeon split open (Peru and Colombia) is not much different from that of the pigeon's fundament, which was a favourite remedy of Shakespeare's son-in-law, Dr. John Hall, as a cure for scurvy in and around Stratford-on-Avon.

All treatments, irrespective of their origins, including those from the scientific world and the useful remedies which primitive societies have independently developed, can be given in an entirely magical sense with spells, prayers, rites, dances, orations, and creeds. Where disease has resulted from a disturbance of harmony, it is common to restore equilibrium by ritual – as in the Ghost-dance – perhaps introducing psychotherapeutic techniques, which, in another setting, scientific medicine would itself accept.

Special days for treatment may be magically favoured (Tuesday and Friday in Peru). Special ceremonies are thought to have value in diagnosis as well as treatment, as, for example, the famous egg-rubbing ceremony for the diagnosis of *ojo* – the evil eye – which

consists of passing a warm, freshly laid egg over the body of a child and then examining the yoke for a tell-tale spot.

Magical interference gives an apparently logical reason for disease and the success and failures of treatment. Belief in it certainly tends to close the mind to possibilities of effective action other than the rite and spell; and it may implant passive resignation to failure. But yet it would be wrong to assume that beliefs in magic are necessarily a hindrance to science;[9] it is much more the habits which hinder what we call progress. Certainly new ideas can be adopted, and given a magical flavour, more easily, for example, than most people can be persuaded to change their habits of defaecation.

Disease is so often seen as a product of culture and social background in the under-developed world that we may overlook the existence of this phenomenon elsewhere. Disease has its social content everywhere, as the modern exponents of social medicine have sought to show.[14] We no longer regard epilepsy, prematurity, mental subnormality, tuberculosis, and a host of other illnesses as entirely, or even mainly, medical. Doctors and hospitals everywhere are beginning to look into the social background of illness. How far this will take us no one now can foresee. Disease may also be regarded as a disturbance of equilibrium between the internal and external environments, and symptoms as evidence of attempts by the physiological and psychological systems of the body to regain an optimum state.[4] In this concept peptic ulcers, ulcerative colitis, and other chronic afflictions of the developed world – possibly multiple stress diseases – may be seen as the counterpart of the nutritional diseases and intestinal disorders of the rest of the world.

Disease is seen also as an escape phenomenon in most, if not all, parts of the world. This is made possible by the fact that it imparts privileges as well as disabilities – exemption from social obligations, the assurance of help, and freedom from responsibility. In this, psychological illnesses in South America, for example, resemble the chronic diseases in England; they can be an escape from conscious or unconscious difficulties. By *colerina* the South American can evade the embarrassing or unpleasant aftermath – and possible retribution – of a fit of anger; as in Europe the misplaced industrial worker or the soldier escapes from an intolerable psychological situation by visiting the factory doctor or appearing on sick parade.

So too in most countries there are reasons for doing nothing about illness until too late. Where chronic diseases are widespread – as with pinta in Peru or trachoma among the fellaheen – just as

in Europe, when slighting references to malaria as the ague were in common parlance – the level of what is regarded as normal health is much lower. Thus the standard of health in many parts of the world includes a fair amount of disease. Disease may be an admission of weakness, and hence shameful. For these and other reasons help may not be sought.

THE FORCES AT WORK WITHIN SOCIETY

The significance of beliefs and customs is increased in all societies by internal forces, which constitute a self-regulating mechanism. We may compare this with the *milieu intérieur* described by Claude Bernard; he discovered that the body maintained a steady internal state by self-regulating devices, which kept the activity of different organs – muscle, liver, lungs, kidneys – within bounds and in harmony with one another, and kept a stable background for the body's extraverted actions. Society, too, has its internal milieu and self-regulating mechanism for keeping its separate members in harmony. Each member feels the pressure of regulation. Such forces are many and varied, and a full description of them is beyond the scope of this short exposition; but perhaps the most important to public health are those which arise through the pressures of conformity, the systems of values and prestige, religious discipline, and social organization.

The Pressure for Conformity

In every society, in different ways, conduct is 'socially sanctioned'. We do what is expected of us in line with others. From our earliest days, for those who follow the rules, there are rewards; for those who transgress, penalties. Social ostracism, from the raising of the eyebrow to the ghetto, is a force of devastating power. It prescribes the goals to be sought, the code of what is done and not done and it interprets present and past experiences according to the culture from which it is born. Few can swim against the tide of public opinion. It is so much easier to subscribe. The well-to-do in West Town in Yunnan contributed to prayer meetings and rituals to fend off cholera, although at the same time supporting hospitals and modern treatment. To do otherwise would have been to defy custom and invite obloquy.[9]

Systems of Value and Prestige

A strong driving force in any society is the set of values which it has adopted and which it rates highly. The value system is a

complex of many individual ingredients, which fit neatly together, each, as it were, in its proper place in one composite whole. Some of the components are to be found in religious teaching; others in writing or sayings of wise men; but most seem to have grown up over long years of usage, in response to the exigencies of the times through which the group has passed. The success motif of the people of North America can perhaps be seen developing in the long years of successful pioneering in the east-to-west trek across the north American continent. Its absence elsewhere, as in Burma, may be a byproduct of religious beliefs. In so many places, as in England, industrialization has produced the cult of the ugly, while simpler societies have found contentment in adornment. Some look forward, and nothing is good that is not new; others look back and live in the past. Such values, whether religious or based on long-established custom, for the most part unquestioningly adopted, are taught to the young with little attempt at objective presentation. In every society the majority believes that its system of values is good and that to act according to it is the right way to live. Taken in, as it were, with mother's milk, this has an enduring quality.

Every society has a prestige system for rating individuals in terms of the culture: in most this is closely related to occupation (see p. 247), so that the more industrialized the greater the range of the scale. This often has little relationship to financial status – thus the learned Mr. C., in Hsu's account of a cholera outbreak in Yunnan Province, ranked high on lists of subscribers, although his donation was small.[9] Prestige of groups within society can also be ethnological or religious, as in caste systems. But in whatever form they arise and are maintained, individuals act or react in accordance with the value which has been placed upon their status, or, if rebellious, they must pay the price.

Religious Discipline

The pressure of religious teaching has been particularly strong in the field of hygiene, including the varying aspects of procreation and family life, which today are part of the teachings of social medicine. The emphasis upon impurity which is found in almost all religious teaching, sometimes carried to extremes and often quite meaningless, was designed to inculcate ideas about cleanliness and contagion which the group needed for survival. The sequestration of lepers, the destruction of houses in which those with contagious maladies had died, the washing of hands, and injunctions against indiscriminate defaection, were woven into rituals.[17] The owner of

an infected house in the early Semitic societies was required to tell a priest, saying, 'It seemeth to me that there is as it were a plague in the house'. When the priest had visited the house and lent his authority, he was to cause it to be scraped within round about, so that the dust that was scraped off could be poured 'without the city into an unclean place' (Leviticus 14:41). The admonitions of Deuteronomy follow similar lines: 'And thou shalt have a paddle upon thy weapon, and it shall be, when thou wilt ease thyself abroad, thou shalt dig therewith and shalt turn back and cover that which cometh from thee' (23:13–14). So much has also been said in similar words for the Brahmins, Parsis, and followers of Islam.

The emphasis which the major religions have placed upon the sanctity of marriage, the proscription of illicit love and of sexual perversions, as well as the strictures on prostitution and the often brutal treatment of all concerned in procuring abortion, have all in different ways contributed to a virile society; so also has infanticide and other means of keeping the population controlled, manageable, and 'feed-able'.

Social Organizations

Conduct also reflects the varying ways in which society is organized – internal groups, and chains of hierarchical authority give strength to the community, but they limit the freedom of action of the individual. In Japan each village is divided, for administrative purposes, into local units, and these in turn into neighbourhood groups of households. All communications must be made through the village official. In Arab society all important matters relating to the welfare of the community – such as those concerning land or marriage – are decided by the group in concert, including the church and all the families. The fellaheen rarely act as individuals. There are many such variations with differing emphasis upon the family, the village, the church, or the state.

THE IMPORTANCE OF BELIEFS AND CUSTOMS IN PUBLIC HEALTH SERVICE

The Preference for Folk Medicine

Scientific medicine encounters many difficulties when it comes into contact with cultures that are different from that in which it was born. The medicine man, everywhere, from the Curandero in

South America to the Inyanga in south-west Natal, has qualities in the eyes of the local inhabitants transcending those of the university-trained doctor. The medicine man seems so much more interested in you; yet he is not so foolish as to waste time and money on the dying. He does not try to isolate you in hospital far from your friends and relatives, among apparently uninterested doctors and nurses, where, as like as not, you will run into difficulties with the disposal of lochia or faeces, or where you may be given food that you know is harmful. Neither does he laugh at you when you ascribe your disease to a punishment for some emotion or to magic. He gives you treatment with his own hand and does not send you to a pharmacist, or ask payment of you in advance of results. He does not reveal his ignorance by asking questions, or by requiring elaborate tests. He does not take notes which may have a magical hold on you. He never says he does not know what is the matter with you.

The disadvantages of the hospital are likewise legion. How easily the evil eye can get through its large window spaces, and how much better to remain at home with a low roof and hardly any window. There may be someone overhead to do you harm (Burma);[18] your talisman may be removed, or your body immodestly exposed. If you are pregnant, you might come under a magical spell by catching sight of a corpse (Burma and some parts of Africa). Hospitals are places in which to die, and where movement is intolerably restricted and human interest minimal.

Environmental Hygiene

Perhaps one of the greatest problems now facing the human race is the disposal of human faeces. To the scientifically trained public health worker it seems to offer little difficulty in its solution. And yet local beliefs and customs are continually stultifying his efforts.

Defaecation in the open spaces, whether due to local beliefs, or, as in Siam and Burma, for aesthetic reasons, is a major menace. The Thai selects a secluded place behind a teak tree, with gentle breezes and a pleasant vista; but for himself and his fellows walking barefoot on the muddy ground there is daily exposure to hookworm. The rains wash down the parasites from excreta into streams; flies settle on the faeces, carry them on their feet, and regurgitate them on to food. Dysentery and intestinal diseases follow.

Housing is similarly involved in beliefs of many kinds. Often people prefer crowded quarters (Mexico). In Egypt the village

resembles an anthill where, at night, man and beasts are huddled together in a labyrinth of alleys.[2] The world is an insanitary place, with water supplies almost everywhere polluted and with little or no sanitation – largely because of these beliefs.

Mental Health

The far-reaching effects of culture and social background upon mental health have in three important aspects – the family, occupation, and industrialization – been dealt with elsewhere in this book. Much remains to be learnt about the distribution of departures from normal mental health throughout the world – in particular the differences between the developed and under-developed worlds.[10] The restrictions on human conduct, as well as the many supporting structures of society itself, are certain to have deep implications for it. These must be studied individually in each area. The effects of social pressure are also to be taken into the account of public health. Pressure for conformity, particularly among the naturally rebellious, is not likely to be without cost to the individual's peace of mind.

Maternal and Child Health

The hygiene of motherhood and infant health is involved even more deeply. A hundred different customs, some beneficial but many harmful, are at work. The hygiene of infancy is less easy to teach when the value of a child is little – as happens in cultures in which human values increase with living. Proscribed foods for the mother before and after delivery can deprive the mother of essential nutrients. Delivery may take place in confined and unhygienic surroundings – although often among friends in a mentally secure atmosphere. There are so many reasons why mothers and babies die, and a dozen more to prevent the development of family planning. How can a man be expected to use a condom in his own marriage bed when this is practised with prostitutes (Puerto Rico)?[18] The endless chain of cause and effect, for which beliefs and customs are ultimately responsible, involves the public health worker so deeply that he had better not begin his activities in maternal and child health than start in ignorance. Very often it has proved a blessing in disguise that very little of what he or she advocates is accepted – unless it suits the people.

Nutrition

Food is the subject of widespread beliefs – apart from hot and cold remedies and the religious taboos. In Malaya, vegetables are thought to cause impotence. In contrast reverence for rice leads to its misuse – 'whatever is eaten, unless there is rice, there is no life in the body' is a popular Malayan saying.[3] In most countries, food is a focus of emotional associations; its preparation may be symbolic of love, discrimination, or approval. To change food habits is often fraught with difficulty and danger. The religious attitude to livestock has been a common cause of failure to use essential foodstuffs. Nutrition is also closely bound up with many other aspects of life, so that to change it in almost any way may have unfortunate repercussions. So great, indeed, is the range of possibilities for nutritional disease to arise from alterations in human society, that no one has yet fully comprehended it. Hardly any action to apply modern public health techniques, or agriculture, or industrial development, can be undertaken without boomerang effects upon the diet, which may result in more harm than good. So delicate is the food balance in many regions of the world that it can be upset by a visiting nurse, an agricultural expert, or the development of a nearby New Town. Change the tortillas soaked in limewater for white bread in New Mexico and the children suffer from a calcium deficiency. Cut short breast-feeding among Hopi Indian toddlers by sending them to hospital and kwashiorkor may result later from inability to buy substitutes.

Syncretization

The culture of a society, although uncompromising and enduring, is yet in constant change, taking in and absorbing to itself new ideas, when these do not conflict with fundamental tenets – a process described as syncretization. The beliefs and customs constitute the product of the past, like a coral reef slowly built by accretion and fashioned by the friction of the waves. All new ideas are at first valued according to existing beliefs; those which have an affinity with something within the existing cuture will be most readily acceptable. Thus it may be relatively easy to accept the germ theory if it can be interpreted in some traditional concept – as where the cleaning of vegetables was accepted as a purification rite, or where vaccination was regarded as a magic charm. On the other hand, those ideas that are intimately tied up with a sense of

security will react with the strongest resistance to change. The rapidity and degree of change will depend upon many considerations. In general, when touching closely the interests of the community without impinging too greatly upon fundamentals – as with new methods of travel – they will be accepted.

Direct attacks on fundamentals may produce the opposite effect of giving them greater strength. This was the case with attempts to abolish female circumcision among the Kikuyu. Where, too, disease is thought to result from a failure to preserve equable human relationships, it may be dangerous to health to introduce new ideas too abruptly. We should also remember that people suffering from stress react negatively – thus a Zulu patriarch refused to allow his family to go to hospital until the doctor had retracted his suggestion that a married daughter had introduced tuberculosis to his family; to have believed this was to make her a witch. The process of grafting on to existing beliefs is generally much to be preferred to any radical operation. In Greece, where the humoral theory of contagion is very strong, it has proved best to allow it to take the place of infection in hygiene teaching. The object should always be to uncover misconceptions gently, and so allow people to find other and alternative means of security.

Beliefs about the nature of disease, generally stubbornly maintained, have changed in most societies over long periods of time. The Hippocratic description of disease, as developed by Galen, appears, eventually, to have reached most parts of the world, and in varying degrees to have been accepted.[8, 15] The adaptation of the Greek teachings to prevailing thought may have been easier in some cultures than others; but most are likely to have welcomed a doctrine of such relative simplicity, which endowed the human being with easily understood remedies for a wide range of conditions – as illustrated in the principle of *contraria contrariis,* treating hot diseases with cold remedies. Yet it took 2,000 years for these to reach South America and complete the world tour.

Syncretization in the modern world increasingly involves the addition or assimilation of scientific ideas. This is, of course, easier for cultures which have acquired some scientific background, and correspondingly more difficult for those centring upon a non-scientific culture. But in essence the process is the same throughout the world. The amalgamation is largely unconscious. The individual in society does not stop to ponder the magical or scientific nature of the phenomenon confronting him.[9]

Beliefs and practices in relation to disease are certainly not

wholly harmful; they may be beneficial or be capable of adaptation to good purposes. The taboos on a large number of vegetables in the Yunnan outbreak of cholera, although considered as part of the effort at pleasing the gods, or of avoiding abdominal cold, may well have helped in limiting the spread of cholera – since fruits were normally eaten unwashed and vegetables were often cleaned in streams and eaten lightly cooked.[9] The general idea of contagion also can help, while the impurity rituals, or patterns of cleanliness of the established religions, and many of the similar practices in pagan beliefs, have been of value to hygiene. These can form the basis of new teaching – providing it is understood that they may not be based upon any appreciation of the biology of infection.

The Training of the Public Health Worker

The practice of public health cannot be isolated or treated apart from the complexities of beliefs and customs; at almost every turn it involves adjustments, many trivial but some fundamental, in this cultural framework. Moreover, success in public health often depends upon modifications outside the purely medical field, so that a knowledge of the community in a wider sense is needed. The community should be studied for its folk medicine, its economics, its family structure, its politics and religion, and for its systems of value and prestige.[8] Such studies are just as important to successful public health as a knowledge of epidemiology and medicine.[13] Thus, it is of value in the South American village of Xochimilco to know that the married couple go to live in the husband's family and that the bride is dominated by the mother-in-law; or why, in the Pacific atoll of Yap, the women interfere with the cervix to terminate pregnancy and so avoid child-bearing before the age of 30.[11] The importance of such studies is well illustrated by the ill-effects of the attitude of doctors at one Latin-American health centre – an attitude found all too frequently all over the world. They were not consulted about magical or psychological diseases, since they had revealed their opinion of them by scoffing. In operating as if the folk medicine did not exist they had greatly reduced their power for good.[8]

Information about beliefs and customs is still woefully lacking despite the claim that the sociologists, anthropologists, and social psychologists have developed methods 'to a point where studies of society by competent scholars can provide basic information to assist all those practical men who struggle with the groups of prob-

lems we list under the head of human relations'.[5] But there is nothing to prevent practical men and women in public health from conducting their own studies. In any case, although the general cultural patterns facing public health are capable of being generalized, the details vary so much that local study is essential.

An understanding and appreciation of customs and beliefs can never be thorough at the outset, since the patterns in different societies are both intricate and varied. Generalizations are dangerous. But armed with the techniques of anthropology – and, perhaps even more important, with the correct attitude of mind – the public health worker can come to understand the significance of customs and beliefs, wherever he works. If he is to work effectively, he must not only see the world as the people do, but also understand the psychological and social functions performed by the practices and beliefs. It is only then that he will be able to apply his scientific knowledge of public health to the best advantage. Understanding of beliefs and customs gives confidence to doctors, nurses, and others, which is essential to success, and it makes possible a sympathetic approach to public health problems – without directly attacking fundamentals. Health education and social anthropology must go hand in hand.

As the public health worker studies the community in which he is working he will also see how greatly the application of scientific knowledge can affect the daily life of the people. Someone has to be responsible for keeping the well in repair and to collect and burn the rubbish. Women have new duties – to light special fires for boiling drinking water, to wash babies' clothes, and to teach the children to use latrines. Getting children vaccinated and changing the diet are major operations.[12]

The main hindrance to the acceptance of scientific medicine is not that the scientific techniques themselves are unacceptable – this is generally far from true – but that the new ideas are clothed in a foreign culture. Public health must get out of its town clothes and put on a simple country homespun. Some have found that it is possible to fit scientific medicine into local culture without introducing irrelevant foreign values, as was the case in Kishan Garhi in the United Provinces.[11] We can at least avoid confusing hygiene with cleanliness, as illustrated by one African township where the maternity home gained favour once the restriction against spitting tobacco juice on to walls had been withdrawn.

Successful techniques are more likely to change ideas than teaching aimed directly at fundamentals. Nevertheless it must not be

taken for granted that good results will immediately carry conviction.[11] Like Snow's contemporaries (see p. 172), people need a lot of proof. Also the often inevitable lack of immediate and clear-cut results tends to be taken as proof that the new method is useless. Misunderstanding as to the object of any measure can also produce unfortunate results. Thus when D.D.T. spraying has been thought to be aimed at the flies, which everyone detests, rather than at the mosquitos, which no one minds, the appearance of 'resistant' flies in swarms immediately afterwards is taken as proof of failure. (Pampana and Russell, see Chapter 19).

In most public health practice, the systems of values and prestige can be turned to good account. Important individuals in the community can be consulted and given an opportunity to maintain their prestige by playing a useful rôle, and not like the influential Mr Chang in one agricultural extension scheme, left out to obstruct behind the scenes.[6] Popular acceptance of any programme is in direct ratio to the degree in which local representatives have taken part in the planning and conduct of it.[16] Local channels of communication can be studied – from the womenfolk gossiping at the well or in the fields, and the men in the coffee houses and on the threshing floors, to the teacher, priest, or headman. The clergy and others with vested interests may oppose change; but always when the desire for new methods is there, precedents can be found to allow it to go forward in tune with existing beliefs.

Finally, the changing of harmful practices will depend upon the gradual growth of understanding about science and its methods, which a general system of education should help to bring about. Lack of a common background and knowledge, which is the great obstacle, will slowly disappear. Great as are the difficulties which face public health in all parts of the world because men and women are so set in their ways and beliefs, they are not insuperable.

CHAPTER 7

Family Life

MAN'S evolution forced upon him the acceptance of the family as the basic unit of society. The long process of gestation and relatively small number of offspring early required that the male should protect the female through the long years of her child-bearing

period. Some form of 'elementary family' – father, mother, and child – is universal in all human societies.[8] When and how this association developed is not known, or what part was played by group marriage, when the woman, as the indisputable parent of her children, occupied a commanding position. The male took the reins of control when trade, in which he could play an active rôle denied to the female, presumably transferred the seat of power – first under polygyny with several wives and a host of children, and later, forced by an increasingly complex economic system, under monogamy, with one wife and a steadily declining number of offspring.

The family is biological, as no other grouping – industrial, occupational, social – can claim to be; its ill-defined and amorphous structure with grandparents, parents, and children and collateral links through marriage, is a phenomenon of growth; and the characteristics of its members are largely the result of haphazard selection from a common pool of chromosomes. It is bound together by a mixture of economic and emotional ties – providing economic, social, and educational services and pooling resources – with its own mores and government. Positive and compelling, it is recognized as an entity by all, including the many for whom government and community mean little or nothing. Families are to the community as individual bricks to a house; but infinitely more adaptable and enduring.

Families throughout the world vary greatly in internal composition and motivation. They live and act differently, have different kinship systems, and varying values and beliefs. They may be small and circumscribed, as in the Western world, or, as in the East, extended to include many relatives, and even strangers. Size and age composition vary with the population structure of the nation (see p. 23). The 'extended family' may live altogether in one dwelling, or a family compound, or it may be distributed throughout a rural community, or live within hailing distance from one 'turning' to another in an old-established industrial centre. Relationships of men and women, attitudes to children, and the respect and support given to grandparents, all vary. In some societies, children early work and earn; in others they continue in education until after manhood or womanhood has been reached (see pp. 32 and 35). In some the cult of lifelong marriage is very strong; in others, as new and more compelling ideologies are taken up, it is breaking down.

Family life reflects in a hundred ways the culture of the society of which it forms the fabric. Life in an extended family in Bali will have little in common with its counterpart in the U.S.A., except the

living together of man and wife and procreation of children. What poles apart are the sexual lives of the children after puberty; the Balinese slowly ripening into adults in a long sexual seclusion; the American satisfying the urge for success in a decade of petting.[14] In France working-class families may be fundamentally opposed to any change of their status, and so as it were fixed socially; in the U.S.A. they may believe implicitly in 'bettering themselves' – although with less social mobility than is often imagined. In a Pacific atoll, the new wife may arrive to crouch in the corner of the tribal hut, a butt for the facetious remarks of her husband's relatives; in a Western city she may take the man she met in the Tube last week to the nearest Registry Office, unknown to any of their relatives.

Every society has its own family peculiarities, and most have great variations at different social levels; but in all the family is the most important unit – for the health of the community, as also for all major social needs. For good or ill, the home is paramount to public health.

THE IMPORTANCE OF THE FAMILY TO PUBLIC HEALTH

The Family and Child Care

The family has its most important influence through the rearing of children – the attitude of the mother, her skill in mothercraft, her biological dedication; the support of the father; and the physical and mental environment, which parents establish, are all involved. Customs of child rearing, which do much to determine the end-product, vary greatly; for instance, the two extremes of baby care – over-protection and active dislike – can both be seen in different tribes of New Guinea. But too few studies have yet been made in detail, even in the Western world. Nevertheless it is obvious that the considerable differences which exist in child care between different communities are of great importance.

Marriage is becoming increasingly monogamous, but where polygyny exists – in Chinese societies, Africa, Muslim areas, and the Pacific islands – and where there is polyandry – in Malabar, Ceylon, and Tibet – divided loyalties may complicate the relationship of parents with their children. Sometimes in China and almost universally in Malaya and other Muslim parts of the Indonesian world, the worst effects of this split in maternal discipline and paternal affection are avoided by having the wives in separate households.[8]

But the more obvious distinctions arise out of different patterns of kinship, authority, adoption, and treatment.

The Western pattern of authority stresses the mother-and-child relationship to the almost total exclusion of the father; but in Asian-Pacific families, father not only shares equally with mother, but also plays an important role in education, by associating the child with his daily activities. The prevalence of adoption in under-developed countries has been said to reflect 'a very general attitude that to have small children about the place is a pleasant and good thing'.[8] No doubt it emphasizes also the greater economic and high social value of children, as well as the population pattern with unrestricted birth rate and the high risks of depletion of the family by death, particularly in childhood (see p. 26). One side-effect of widespread adoption is to reduce the problem of babies born out of wedlock to negligible proportions, since they are accepted and treated with normal care.

The treatment of children in West and East tends also to follow a different set of rules. In the West discipline is more rigid and, speaking generally, independence is less encouraged. In the East child care is more permissive, starting with the 'on demand' feeding at mother's breast, which continues throughout the long suckling period – a great safeguard, incidentally, against protein malnutrition in Fiji and Africa, until the white man knew better. The excessive emphasis upon discipline in elimination of excreta, which is a feature of Western society, is much less marked in the East.

The West, as part of the process of industrialization (see Chapter 13), is much more nearly dependent on the elementary family; but in the East, as in under-developed countries generally, a much wider kin group is involved in child care. The child knows a wide circle of relatives, who participate actively in the family circle; with these he is intimately associated – in sleeping, suckling, feeding, and, in the early years, excretion, which takes place in the presence of others than the parents, without embarrassment to anyone. Hence, not only is the child's relationship with his mother more diffuse, but, correspondingly, he develops bonds of affection and authority with a much greater circle of relatives.

Western studies have emphasized the part played by the home in development of personality and character – the end-product of the interaction of the environment and the genetic make-up. Home moulds us like clay on the potter's wheel. Loss of the security, which is as necessary to the balance of the child's mind as an anchor is to a ship, and 'emotional deprivation', are the chief dangers. The

broken home can give rise to behaviour disorders, or to faulty development – much as the tubercle bacillus may cause phthisis.

In the home that has foundered in disharmony, the children can become confused and unhappy, afraid, angry, distressed, and, less often but yet all too frequently, aggressive. They may do damaging things to people or property, probably as a relief to their pent-up feelings, or as a revenge for injustices which loom large in their young minds. Anti-social behaviour in the Western world commonly has its roots in the parents' lack of affection.[12] In some cases the result is delinquency – some anti-social act, which by chance puts the child outside the law. Some children become neurotic – restless, seeking attention inordinately and displaying affection indiscriminately. The very young, deprived for long of their mothers, can present a harrowing picture of misery and apathy. Failure of development may give rise to instability, or inability to make relationships – the so-called affectionless type for which the most important cause appears to be the lack of a continuing relationship, during the first few years of life, with one satisfactory 'mother'.

Most children from unhappy homes make useful adults; some, no doubt, much above average. The mother who gives birth to an abnormal child usually manages to steer his or her emotional development between the Scylla of rejection and the Charybdis of over-protection.[9] Men and women of great creative abilities have had unsatisfactory childhoods. Darwin produced the *Origin of Species* despite, or possibly because of, his father's stern repression. The mother's role can be played satisfactorily by others, as it was by Maria Millis as nanny to the young Shaftesbury, who was later to help to free the European child from the cruelties of a new industrial system. Much may depend upon constitutional weakness. But the broken home seems to have a self-perpetuating character, since its children appear more likely to reproduce the episodes in their own lives.[2,6] We know too little of the life-histories of such children – much that we see in failure in the Western world may be part of the changing pattern of family and society, which development seems to entail (see p. 19).

The Family and Sickness

The family also is the first defence in caring for sickness and in welfare. No system of social security, in developed and underdeveloped countries alike, would ever replace the family system of loans without interest, gifts in money and kind. Over large parts

of the world, as in Thailand, the family supports relatives and often strangers in adversity; and it adopts and educates the children. In the three-generation family, even in an old-standing industrial slum, and still more, no doubt, in long-settled agricultural communities, the care of dependants at both ends of life – always one of the great and indispensable functions of any society – is a family concern. For the welfare of the aged and of the handicapped, the family shoulders more than 90 per cent of the burden.[17] Adolescents, particularly those who continue in full-time education, and adult workers, lean heavily upon it.

Sickness is always a family event; no member can be ill without affecting the others, so that, even when the doctor or the hospital is involved, the family must always be considered. The great problem in all families is what happens when sickness comes. When mother is ill or confined in old Bethnal Green, grandmother and relatives rally to her aid. In one form or another, given reasonable proximity, the family will devise its own aids to sick nursing.[20] Father has no need to stay away from work to nurse his family, except in the new housing estates, where the balance of the three-generation family has been disturbed. The family does more nursing than the hospital, even in highly-developed countries, and, according to sickness surveys, largely without the aid of the doctor.[18] Many consider that too much attention is given to hospital provision and that well-organized schemes of home care have much to offer – financially, socially, and psychologically (see Chapter 11). No form of National Health Service, in any event, can hope to succeed without the support of the family.

But the home can also cause illness. The human family is a happy hunting ground for the bacterial world; psychologically it suffers from tension; physically it may fail to keep pace with its own growth, with too little food or space; socially it may lack strength of purpose, or adopt unhealthy practices. Tuberculosis spreads within the family group – indeed for this reason it was long regarded as hereditary. Deaths from accidents to children in the home, in a developed country, exceeds those on the roads. The problem family produces educational subnormality, as well as other forms of social disorder. Many social customs and beliefs about feeding during and after pregnancy, and other details closely associated with family life, are known to produce illness (see Chapter 6). There is also an important difference in the extent of illness in different types of home; premature birth, stillbirths, and infant deaths, as well as maternal mortality and morbidity, all increase as socio-economic standing of

the home declines. The steady decline in infant mortality, which has taken place in the developed world over the past fifty years, has left intact the proportional difference between the rates for infants whose fathers are unskilled workers and of those whose fathers are professional men. Children of unskilled workers continue to be more likely to fall ill with respiratory infection, gastro-enteritis, and the childhood infectious diseases. Larger families, possibly because of overcrowding, have a greater chance of illness; the chance of dying is greater for the fifth than it is for the first in the family. Social surveys – the modern tool for gauging the forces at work in society (see p. 282) – repeatedly focus attention on the home, as the main factor involved in important national considerations. Few examples of this would be more eloquent than the significance of the family to education – in Britain equal opportunity according to age, aptitude, and ability, may still be denied to those with inadequate homes (see p. 278).[15]

THE FORCES AT WORK UPON THE FAMILY

The strength and stability of the family, as an agent in public health, depend upon the interaction of many forces both from within and without – housing, social aspirations, psychological disturbances, kinship networks, and demographic changes. Social aspirations drive the housewife to home-making up to and beyond the limit of the budget. Demographic changes re-fashion the family; new housing estates tear it up by the roots and replant it far from accustomed habitats. The slum dwelling – so terribly destructive of ordered family life – must be viewed in the perspective of the friendliness and sociability of slumland.[20] Emotional conflicts and personality defects – the unbridgeable gap between unrecognized or fantasied expectation and actual performance on the part of the spouse[16] – can undermine marriage. Sexual relationships, which may themselves be dependent upon childhood experiences, may determine happiness and affect the atmosphere of the home. Lack of organization – poor homecraft, poor family planning – imposes a great strain upon it, as may in some respects the working mother.

Housing

Cave man, as his family grew, occupied more of the deeper recesses, unconcerned with the many refinements of twentieth-century housing: dangers of overcrowding which increases risks of infection to the young and spreads the tubercle bacillus and other

organisms in massive doses; hazards to mental health of house-sharing for young married couples; pure water supplies, the flush closet, seclusion for the secondary school child to do homework, the damp-proof course, light and air, labour-saving kitchen equipment, without which mental, physical, and social health may be unattainable. Today we know of these dangers, but we still, except for a very few, have not been able to meet them. Many families still live in slums where all the hallmarks of a healthy home are lacking (see p. 102).

The developed world is crusading to get rid of its industrial environment of slums. More and more slum-dwellers are going to suburbia and a few to new towns (see p. 102). Yet the paradox of the modern world has been a decline in housing standards, which have accompanied scientific understanding of what health – physical and mental – demands. Increase in numbers of people, and the world-wide demand for town living, are great obstacles. As families get smaller and split into larger numbers of household units, the difficulties increase. Lack of privacy 'helps towards less rigid forms of child discipline'. But as privacy becomes more valued for its own sake, the single-room house, which is all that so many countries now provide, is sadly wanting.

Social Aspirations

For the so-called middle class of the industrial society, the quest for advancement is one main driving force, which builds up a different pattern of family life from that of the manual worker.[10] Non-manual workers – social classes 1 and 2 and the clerks and shop assistants of social class 3 (see p. 245) – centre their lives upon the family and plough back the greater part of the income into it; their conduct is a family concern. Thus the family is a self-conscious unit, bound together by centrifugal forces. It aims at bettering itself. The manual worker tends to centre his life more upon his workmates than upon his home; his recreational activities have a first call upon his earnings; his conduct is the concern of his colleagues. Resignation, rather than recovery, is the family attitude to all misfortunes, including ill-health.[11] In this setting, aspirations to social improvement are frowned upon.

Such relative lack of support by the male, which weakens the family, at least in terms of public health, is growing less. Bethnal Green[20] in London has changed much since the time of Charles Booth,[1] and still more from that of Mayhew[13] and the days when Dr Barnardo and Lord Shaftesbury poked under tarpaulins in dead

of winter for homeless children.[3] The husband is more identified with the home; a new companionship between husband and wife is growing up with a rise in status of the young wife and children. An old Glasgow slum has recently been shown to have a much improved 'atmosphere'.[7] The old type slum dweller, irregularly employed and flitting from place to place, with a home only in name, has been replaced by a new breed of persons who live in slum property for want of anything better. Not that all slum dwellers want to leave the old friendly atmosphere – many, in fact, hesitate to take on the higher costs of a good home; but few fail to value the advantages of a good house as the basis of a sound home. In the new housing estate, to which many have gone from the slums of industrial Europe, the husband's identification with the home has gone a step further; he sacrifices his own luxuries to make possible higher standards.

The competitive spirit to which attempts to 'keep up with the Joneses' give rise is affecting family life all over the developed world. The window-to-window relationship of suburbia – in the new housing estate with its unexpected exclusiveness – helps to drive families into competition. The home now comes first in the family budget – curtains, carpet, kitchen gadgets, telephone, lawn-mower, car. Rising standards stamp their pattern upon all but the most independent and detached minds. 'Mrs Jones' is as censorious as 'Mrs Grundy'; she frowns upon the roof without the television aerial and the kitchen without the electric washer. Thus she drives women to work outside the home and helps to build up the load of weekly-payment purchases.

No one can dispute that the modern house is better than the 'family per bed' space in the half-demolished warehouses of Rangoon, the shacks in the Negro quarters of Atlanta or Johannesburg, or the underground dwellings in Moscow or one-time Liverpool. But there are losses as well as gains. The new equipment in the modern American home 'has led not to more leisure, more time to play with the baby, more time to curl up and read by an open fire . . . but has merely combined with other trends in making the life of the American home-maker not easier, but more exacting'.[14] Or, possibly, new standards lead to new demands and to changing values about the use of time.

Rising standards can also make demands upon the family budget which lead to sacrifice of essential needs. The biological expansion of the family must materially straiten the budget. 'Having a family was a guarantee of poverty for the working classes in the 1930s . . .

poverty is concentrated on children, those with dependent children to support, and the old.' Many surveys have shown that the proportion of protective food declines as the family grows and that new housing estates have helped to exact this penalty. Anxiety, that ill-defined enemy of the public health, can get to work more easily where every halfpenny is already bespoken – another straw, and the camel's back may sag. The isolation of the new family units – from grandparents, friends, and acquaintances – also contrasts sharply with the old slum. The modern 'baby-sitter' tells a story.

We have yet to see whether these new ventures, physically so desirable, can build up the friendliness and helpfulness of the old slum. Unless this is done, some of the gain to health will be lost in the increasing strain of child-rearing and decreasing support in sickness. We have still to learn how to rebuild the three-tier family relationship in circumstances where the children are not permitted to take over their parents' house. The bulging schools of the first years of a new housing estate, or town, may be empty in twenty years.

The Working Mother

Women throughout the under-developed world work equally with men, but they do so from home (see p. 21). A phenomenon in most, if not all, industrial societies, is the woman who goes out to work leaving her young children to be cared for by grandparents, relatives, or child-minders, or in nurseries. Russia is said to have half a million permanent places in nurseries and to make arrangements during the height of harvesting for up to 5 million. In Britain there are rather more than 50,000 such places. We cannot here discuss the many issues to which this aspect of life in an industrial society gives rise. Suffice it to say that 'The proper place for an infant under two years is at home . . . Mothers with children under two years should be discouraged from going out to work. Day nurseries should be regarded as supplementary to nursery schools and classes'.*

Kinship Networks and Demographic Changes

The strength of the family depends much upon kinship networks, however bizarre the patterns that these may exhibit in different parts of the world may appear. The attachment of mother and daughter – a common finding in surveys in industrial urban life – is possibly an outcome of the Industrial Revolution, which detached the father

* Ministry of Health Circular 221/45.

as the wage earner. But something similar no doubt operates widely. Kinship, as we have seen, is the key to self-help systems and possibly to mental health. A nice interaction of length of residence and kinship makes for happiness and security in the old industrial slum, where the family does more than anything else to make the local society a familiar society, filled with people who are not strangers, where people are not lonely, where, whenever they go out for a walk in the street, for a drink in the pub, or for a row on the lake in the park, they know the faces in the crowd.[20] Familiarity breeds content.

When families get smaller, inevitably some of the power of the family is sapped. In Western Europe and the New World, this change has gone far. The sickening stream of infant funerals, although rationalized, and the deadly fears with which young lives are surrounded throughout nine-tenths of the world, have at last ceased in the Western world. No longer are 'the sufferings of the children thought of as inevitable, and even as reasonable'.[19] Children are no longer born to die. But, where the birth rate has fallen to a mere replacement level, uncles and aunts are fewer. More wives are left to carry their burdens alone. The increasing burdens of the aged fall upon too few shoulders.

THE IMPORTANCE OF PUBLIC HEALTH TO THE FAMILY

However much it may vary in different parts of the world, the family should be the fulcrum of the Health Service. A sound public health service will make an ally of the family, seeking to understand the springs of its action and how to bring scientific knowledge to its aid; strengthening it from within and supporting it from without.

External supports may need to be medical, social, economic, and psychological. First, if we are to treat the family as a living and growing organism, it must logically have a family doctor – not, as so often is the case so widely throughout the world, a physician who looks upon sickness as a source of income. The family doctor should work, wherever national resources permit, with midwives, nurses, and social workers to promote the health of a group of families. One means to accomplish this is the Health Centre – the operative unit for family care within a larger administrative 'health unit'. Social work, like doctoring, should be on a family basis, and every effort should be made to limit the number and variety of social agents who handle separate and limited aspects of family case work. Special measures will be needed, if possible within the public health scheme, to deal with problem families and illegitimate pregnancies.

Social and economic measures to support the family need to be specific in their action, if full benefit is to be gained. General measures of support, such as food subsidies, a national health service, unemployment payments – which are being developed as a means to vanquish the five giants, Want, Ignorance, Squalor, Sloth, and Disease – benefit the families incidentally rather than specifically. Family allowances, school meals and milk, reduced rentals, the cheaper purchase of clothing, and subsidized holidays can do much more to meet the biological stresses to which a growing family gives rise.

The solution to the problem of family housing will vary from Japan to Jamaica. But whatever slant the particular culture of a nation may have, or the climate, or the kinship network, the fundamentals of hygienic living are the same. The single-room units of a family compound in Bali have the same need as elsewhere for light and air, for kitchen amenities, for pure water and sanitation; and those of Japan, with their paper partitions, must contend with the same frustrations as the one-family rooms of Moscow or the overcrowded two-up-two-down in Newcastle upon Tyne.[3] Public health is bound to put housing high on its list of problems; this is perhaps why the Medical Officer of Health should be responsible for the health aspects of housing – nothing less than his unremitting efforts can remedy the appalling conditions which everywhere exist. The building of new towns and overspill suburbs needs to be undertaken with particular care, with the lessons of suburbia in the Western world in mind. The possibilities of reconstruction in old worn-out environments needs more study, as does that of re-establishing the three-tier family in new housing estates.

Internal supports for the family are less easily managed Here we are involved in the spiritual, moral, and cultural life of the members, and of the society of which the family forms part. For the families at the bottom of the occupational ladder who present industrial societies, at least, with almost the greatest modern challenge, the first essential is an understanding of the motives which determine their lack of co-operation and unwillingness to 'progress'. Improvement in the health of unskilled workers and their families would proceed much faster if all doctors were aware of the extent to which their own attitudes and behaviour, as well as those of their patients, need to be modified.[11] Much the same indeed may be said for all the world. Only proper study can provide us with the information we need in any country.[8] Teaching is our only weapon, but it cannot succeed unless it is based upon understanding of the mental make-up

of those being instructed. We must learn how courageous it is for the mother to 'break with tradition and the expectations of her group'.[4] Lack of knowledge of human biology, one of the great barriers to understanding, has also to be remedied. 'For the majority their knowledge is like confetti, little islands of disconnected information acquired from a variety of reputable and disreputable sources. This knowledge is set in a jelly of rationalization and beliefs derived from folklore and the more sensational theories of bygone days.'[5] Learning about these again often means learning about ourselves (see Chapter 6).

Finally marriage guidance can logically be looked upon as a part of public health – as a means to instil an understanding of the upbringing of the family which often comes only with years. The value of security and affection to the young child and the dangers of disharmony in the home are more easily grasped by grandparents than parents, but they can be taught. Teaching becomes all the more important as the need for family planning extends (see p. 83). When also the liberty of the subject and the right to advancement is enthroned, as in America, teaching the social and biological significance of the family becomes an essential support for family life, whose ties are weakening.[14] Teaching may do something to make the family a first call upon all the resources of money and effort – without the blind acceptance of the philosophy of 'keeping up with the Joneses'. Marriage guidance may also do something to combat disharmony when the children find themselves in an atmosphere of warring personalities – it is better if possible to mend the home rather than break it, since love and security are hardly to be found elsewhere. Public health is involved in them all, from the kitchen to the marriage bed.

The world is on the move; migration, social mobility, industrialization, changing beliefs, the abandonment of old ways of living, all increase the strain upon the family and call for further measures to preserve it. For the protective care of kinship groups, tribal elders, and family councils we must learn to substitute wider social institutions.

Lastly, we need further studies of marriage and the family. The causes of marital disharmony are to be found in highly complex interactions of personal and social conditions. We need to understand them better, as well as the structure and function of families in different communities and their adaptation to a changing environment.

CHAPTER 8

Population

THE IMPORTANCE OF POPULATION TO HEALTH

HEALTH in the group depends upon the dynamic relationship between numbers of people, the space which they occupy, and the skill that they have acquired in providing for their needs. Public Health is, therefore, vitally concerned with population – the numbers of people, their distribution, their movements, the age structure, and the birth and death rates in specific age groups. The practice of public health will also vary, for good or ill, with the effects of man's activities, for as people multiply they create new opportunities for health and fresh perils; as they migrate such opportunities and dangers, new and old, go with them.

Over-population affects the health of the community, physically and mentally. It undermines physical health by increasing the risks of infection and by the more subtle, but powerful, influence of malnutrition; by shortening life; by disrupting the family through deaths of its younger members; by damaging the health of the childbearing population through frequent pregnancies without any corresponding gain; by denying the community many of the essentials of health. Mental health suffers because of the hopelessness of life in circumstances where there exist neither houseroom, food, well-being, nor any of the essentials which make a life of fulfilment and purpose possible.

World public health also has to take account of the strong feelings between nations to which population problems can give rise. Not only have means of communication brought all peoples into touch with one another, but to a large extent there is interdependence. The difficulties of living, and its opportunities, have become world problems – no longer can any people easily starve in isolation, nor can any enjoy the fruits of the earth unaffected by another's misery. The great differences which exist are sources of frustration and tension. Nations today disagree about the interpretation of population trends and also as to the proper course of action to be pursued.

Similar feelings exist within individual countries, where there are different ethnic groups, with varying economic, social, and intellectual developments. Thus the differential birth and death rate may be adding to the tension between whites and Negroes in the United States, the Union of South Africa, and various colonial territories, between Hindus and Moslems in India and Pakistan, and between Chinese and other peoples of South-East Asia. Such tensions are greatest where discrimination exists, but they are present in almost every community in varying degree, both in countries such as Canada where two national groups are treated on an equal footing, and also in homogeneous states where there are differential rates of propagation and survival in social classes.

GROWTH OF POPULATIONS

Slow Growth until Recent Centuries

Man spread to most parts of the globe a very long time ago, and in every part his numbers increased. Little is known about them for certain before A.D. 1000, when the population was approximately 275 million. It then accelerated progressively until about the year 1650, when a total of some 445 million had been reached. Before this time the total population of the world probably fluctuated within narrow limits, but the range and extent of the fluctuations is not known.[1] Sometimes it advanced rapidly, sometimes slowly, and no doubt often – as is known for certain during the fourteenth century – the world total declined. The human race seemed to fare better in some regions than others. Thus in Japan up to 1750, and in the Americas up to 1500, the rate of growth seems to have been greater than in Europe, India, or South-West Asia. Some of this advantage may have been due to differences in the prevailing diseases, and much no doubt to variations in habits of life.

Since neither the capacity of the human female to bear young, nor her opportunities, despite slavery and polygyny, are likely to have varied greatly in human history, the even balance of numbers must have been maintained by deaths – before, during, and after birth – from war, disease, famine, disaster, and human interference. The average mortality of about forty per thousand, however it may have been built up, seems generally to have been offset by the addition of young at something like the same rate. The importance of each cause of death has varied at different times throughout the world. Deaths in war – the continual drain of persistent tribal

incidents, as in Africa, perhaps more even than the massed slaughter of conquests, which occurred for several centuries in South-West Asia after 1258 – have played their part. Calamities including famine have been frequent and harrowing, but probably, as a total cause of restraint on population growth, they come a long way down the list. The extent of infanticide and abortion has varied with local circumstances and values. The peoples of earlier civilizations – Egyptians, Hebrews, Hindus, Chinese, Greeks, Romans, and Teutonic tribes – all resorted to them.[5]

The killing of female infants – always to be suspected when males much exceed females in the adult population – has been a deeply rooted custom among nomads and hunters, for example, in Africa, South-West Asia, and India; it was practised in England before and after the Black Death; it caused the cessation of population growth in Japan between 1750 and 1850 during the Tokugawa era. Abortion, by artificial interference and by medicines, has been widely practised; sometimes, as on the Pacific atoll of Yap today, it has caused a heavy decline in population.[8] But both infanticide and abortion have been strongly countered by religious sanctions, which have had their roots in the urge for survival, so that high fertility has generally been encouraged throughout man's history.

Yet it is to death from disease that we should probably look for the chief cause of population restraint – particularly to deaths in the young. Infant mortality must always have ranked high, since to the ever-present risks of infection have been added the hardships of life in primitive societies.

Expansion after 1650

After the middle of the seventeenth century – for the past 300 years – there has been a marked change in pattern with rapid growth and constant acceleration. After the lapse of 150 years – i.e., by the time Malthus[6] wrote, in 1798 – the population had doubled, to reach 920 million. By 1967 it had reached 3,250 million. The population of the world increased between 1650 and 1700 by 20 per cent; in the half-century from 1900 to 1949 the rate of increase had advanced to 52 per cent; the addition of people to the world population between 1900 and 1949 was 800 million – as much as during the previous 800 years.[1, 14]

The change in population growth since the middle of the seventeenth century was almost certainly due, not to any change in female reproductive capacity, but to a decline in overall mortality dependent upon new ways of living and new forms of society. Developments

in commerce, in technology, in geographical exploration, and in political reform – none wholly new – now advanced so rapidly as to have the character of revolutions. Europe was the motherland of most of these changes and, in consequence, it was here that the swarming process began. After 1750 the Industrial Revolution in England (see Chapter 13) added further impetus. Then the whole character of life in Europe began to alter. The industrial areas became hotbeds of infection; infant mortality advanced alarmingly and pandemics of fever slaughtered young and old. But simultaneously living conditions outside the industrial belts were improved, a new agriculture produced more abundant and varied foods, and new amenities softened the harshness of life. The new public health, born at the end of the eighteenth century (see Chapter 14), played an increasingly important role.

Between 1650 and 1950, the population of Europe advanced from 100 to 541 million, and Europeans including those in other lands to 641 million; the 2 million in Oceania had become 13; 12 in Central and South America 162, and one in North America 166. The first advance in England, from 5 in 1750 to 25 million in 1850, was perhaps the most spectacular, but the whole of Europe and the New World was soon involved. Moreover, if Europe was first off the mark, the changes in living, which were at the root of this phenomenon, were not long in spreading to distant regions. The Far East had become involved certainly by the middle of the nineteenth century; the 339 million living in Asia in 1650 had become 1,320 million by 1950. The increase in population in Japan from 30 million in 1870 to 95 in 1957 is certainly as spectacular as that of England. India advanced from 255 in 1871 to 500 million in 1967;[1a] Egypt from 4½ million in 1846 to 19½ in 1947. In contrast, the supposed 100 million in Africa in 1650 had no more than doubled by 1950.

During the second half of the last 300 years, the impetus of population increase has shifted from West to East, or more properly from developed to under-developed countries. The rapid fall of death rate has been countered in the developed countries by a corresponding fall in birth rate – so that the population increase has everywhere markedly declined; in North, West, and Central Europe the birth rate now lies between 16 and 19; in Southern and Eastern Europe, the U.S.A., Canada, Australia, and New Zealand, it is a little higher, at 20 to 24. The net effect upon population levels is still subject to fluctuations and variations, as in the U.S.A., since the Second World War, but in total the population of the developed world gives the appearance of a juggernaut, which has come to rest.

Thus it is that, until 150 years ago, while the birth rate remained constant in Europe, changes in economic and social well-being were reflected in death rates. Since this time the death rate has declined to reach a more or less stationary lower limit of 8 to 11 in North, West, and Central Europe (as also in America north of the Rio Grande, and in Oceania). Population now fluctuates only with alterations in the birth rates. The decline in population has not been uniform in all sections of the population. It began with the professional and managerial classes and has spread slowly through the non-manual to the manual elements. Thus the gap between manual and non-manual groups has widened.

In the East death rates are now falling much as they did in the developed world after 1650, or more especially after 1750, while birth rates remain at, or near to, the maximum. Mortality in Asia, Africa, and much of South America still resembles that of Western Europe before the Industrial Revolution, varying between 25 and 35, but reductions have occurred in most parts, and in some these are substantial, if not spectacular. In Japan the death rate in 1964 was 6·9; in Ceylon in 1951 it was 12·9, only five years after the malaria campaign had been started, 11 in 1955 and 8·7 in 1964; in Egypt (1963) it was 15·3. Such evidence as exists suggests that the changes have begun, as they did in the Western world, in the highest of the prestige classes.

The changes which have taken place in the birth rate in the developed world have hardly begun in Latin America and the East, where the figure remains at or near the maximum of 35–45. Thus in Ceylon, despite the spectacular fall in death rate, the birth rate, 38 in 1951, was still 33 per thousand in 1964, leaving a natural increase of 3 per cent per annum. In a few instances at least, although not universally, the birth rate has a tendency to *rise* with the first impact of industrialization – as in the Belgian Congo, Honduras, Malaya, Nicaragua, South and South-West Africa.[5] A substantial fall has occurred in some countries, as in Japan, where the birth rate was 31 in 1946–8, 19 in 1956 and 17·7 in 1964; and smaller, but noticeable, falls have occurred in India (38), Ceylon (33), Puerto Rico (30), and possibly China.[4]

Considerable disparities now exist between the countries of the world in the extent to which the population exceeds or falls short of the optimum. Some countries, for example, India, Java, Egypt, greatly exceed the optimum density; others, no more developed, such as Turkey, Thailand, and Burma, could with advantage have more people; still others, such as Japan and the United Kingdom.

maintain very high densities on the proceeds of highly-developed industrial systems. But every country which has not settled to a lower level of population stability – with a low birth rate to balance the low death rate – is in danger of finding its population greater than its resources, as modern developments begin to exercise their full impact. All the countries of the world, whatever the state of their population, are now in the same boat together, with the same stake in preventing it from becoming overloaded.

Technological advances and superior wisdom can perhaps overcome every existing difficulty. Certainly for many countries today in dire straits, where population has grown beyond the resources of the land, industrialization is looked to as the only answer to immediate difficulties – as in Egypt with its extremely high densities on all the cultivable land. All such changes are to be encouraged. Yet it is evident from our history that we tend to expand to the limit, and to make use of every gain to increase our numbers – new lands become filled and old lands are made to take more. To this process there must be an end.[1a] Malthus' contention that population must 'press upon' the supporting power of the land is true, even if food production be increased a thousand times.[3] In short, the growth of world population in the last 300 years does not express a trend, and it cannot be projected indefinitely into the future. Rather has it been a unique, unprecedented, and unpredictable phenomenon of limited duration.[14]

THE DEMOGRAPHIC CYCLE

The history of populations since 1650 suggests that national growth takes place according to a cycle in which five stages can be arbitrarily defined. The first stage, from which each nation begins, is that in which population is stationary because a high death rate cancels out a high birth rate (high stationary). The second occurs when the death rate begins to fall while the birth rate continues at or near to the maximum (early expanding). The third is that in which the birth rate also begins to decline; the population continues to grow because the numbers born exceed those dying (late expanding). In the fourth stage the population again becomes stationary, with a low birth rate and a low mortality (low stationary); and in the fifth the population declines because the babies born are fewer than the deaths (declining).

Demographic cycles are likely to have evolved in previous civilizations. The Roman civilization may well have reached the fourth

and fifth stages somewhere between the second and fourth centuries after Christ. In our own the cycle of population growth began, under the influence of development, at different times and places throughout the world. No known people now exists, however physically and culturally isolated, that has not been influenced, either directly or indirectly, by industrialization, or through contact with its products. Colonial influences, wherever they have occurred, particularly in the field of public health, are certain to have led to some decline in mortality. On this basis every nation should at least have reached stage two of the cycle – indeed must have, if we are to account for the world-wide increase in population since 1650. It is doubtful whether it is any longer possible to distinguish between countries in the high stationary and early expanding stages. China Major, conjectured at 70 millions in A.D. 1000, 150 in 1650, and perhaps five times this figure in 1957, is still arbitrarily placed by many in the high stationary phase, because, in terms of its great size, its population gives the appearance of a standstill; but in reality the death rate is already declining. Of the other countries which are generally placed in the high stationary phase – Afghanistan, Arabia, Ethiopia, Indonesia, Persia, parts of South America, and almost the entire African continent, except perhaps the Union of South Africa – it is hardly possible to say anything with certainty, in view of the almost total absence of vital records (see Chapter 22).

The regular sequence of cycles is not easy to follow, particularly since the great changes in death rates which have occurred in recent years. As late as 1952 many countries were placed in the early expanding phase – India, Pakistan, Burma, Ceylon, Thailand, Indo-China, Formosa, Korea, parts of the Middle East, Turkey, Madagascar, Mexico, Central America, and parts of South America;[14] many of these today would need to be placed elsewhere. In the case of some the margin of difference between births and deaths is too great. Ceylon, for instance (1964), has a birth rate of 33 with a death rate of 8·7, Malaya (1963) 39 and 8·9, Thailand (1962) 35 and 7·9. In others as in India, where the recorded birth rate has already fallen to 21 and the death rate is 13, the step to late expanding seems already to have been taken.[4] India, even if the true birth rate is nearer to 40 per thousand,[1a] might now properly join the Soviet Union, Japan, Argentina, Poland, Bulgaria, Rumania, Yugoslavia, Italy, Spain, and Chile, where the death rates are low and the birth rate already declining. Much the same can be said for countries in the low stationary phase – western, northern, and some central parts of Europe, U.S.A., Australia, and New Zealand. Since

the Second World War many countries of the Western world have experienced a striking upsurge. The United States in particular has had a natural increase of about $1\frac{1}{2}$ per cent per annum, a rate higher than that of Great Britain in the period of rapid expansion in the second half of the nineteenth century. The final stage of declining births is, of course, hypothetical. Before, or at least soon after, it is reached, nations take vigorous measures to counteract it. Every nation tends to regard its own culture as the finest in the world, and none readily contemplates its extinction. A rigorous policy of support for the family – as in France, the only country so far to have experienced stage five in the modern era – redresses the balance.

MIGRATION

The migration of peoples from their homelands, which tears up the family by its roots or disrupts it by the removal of cherished members, although age-old, has in recent centuries added enormously to the problem of public health. As a by-product of so many human activities – war, famine, disease, industrialization, religious persecution, over-population, and exploration – it has taken millions far over the high seas and across land masses, or perhaps no further than to the newly-built industrial areas, but always to a new environment, where customs and cultural ties differ and new hazards have to be met.

In past times, the overseas migration of perhaps 60 million from Europe – Spaniards and Portuguese to South America after 1400, Dutch to South Africa after 1700, and English and other Europeans to North America and Australasia, especially in the Great Resettlement between 1870 and 1920; the exodus of 15 million slaves from Africa to the New World, chiefly in the seventeenth, eighteenth, and nineteenth centuries; the nineteenth-century internal migration eastward in Russia and westward in North America; the uprooted millions from the villages of England during the Industrial Revolution (see Chapter 13); Chinese to Indonesia and Thailand, Indians to Burma or Africa; in more recent times, the influx to Israel, the displacement of Europe's millions after 1939, migrant labour in the U.S.A., and the trek to industrial townships in Africa and South America – all such movements of human beings from their accustomed habitats have features in common and all give rise to endless problems in public health – in epidemiology, in social disease, and in cultural assimilation. The ill-effects upon individual,

family, and nation will vary with the extent of dispersion within the receiving nation, with the degree to which ties with the homeland are kept up, with the maintenance of separate ethnic groups, and with intermarriage, as, in earlier centuries, of Spaniards in South America, or more recently of Chinese in Thailand.

Insecurity is a common characteristic, manifesting itself in a dozen different ways – the congregation of ethnic groups, formation of minorities, and clashes between races. Anxiety is more prevalent, and also psychosis, if what has been found among New York immigrants can be more generally applied. Witch doctors have multiplied in urban South Africa. Cultural conflicts – between the first and second generations and of children and parents – disturb relationships. The population structure lacks balance, with few children and old people, and often less women than men. Living conditions are bad, with poor housing, overcrowding, and slums, and no knowledge of how to keep healthy. The habits of the old environment are ill-adapted to the new. Diseases, such as syphilis and tuberculosis, spread. Maladjustment and spiritual anarchy weaken the organic unity of the new society.

THE FUTURE

The growth of the world's population, viewed as part of a complex of demographic cycles, seems to be a self-limiting process. Development, including industrialization, establishes a number of new and potent processes which tend to a decline in birth rate – rising income and consumption, improving education, emancipation of women and their employment outside the family, increase in physical and social mobility, improved security for old age, and the secularization of cultural values and institutions. The fundamental change is in the system of cultural values – the belief in high fertility gives place to a desire for other forms of fulfilment for the family. Mrs Jones, a less desirable addition to the system of values, comes to exercise her influence by raising the appreciation of success and the desirability of climbing the social ladder, for both of which too many children are an encumbrance. Many changes in a developing society also reduce the immediate economic value of children.

The assumption that population curves will eventually flatten out is therefore not fanciful, even if a final figure of 5,000 million is little more than a guess. But it is the time factor which is now important, since the advent of modern public health has greatly accelerated the decline of mortality. Cultural values change slowly and reactions against rationality are strong; meanwhile economic development

may result in larger not smaller populations for an inconveniently long time. The under-developed world can aggravate its own problems, as indeed has happened in Puerto Rico, by concentrating all its attention on reduction of mortality alone.[8] Moreover, since the artificial limitation of increase in Western society has been the result of desires for economic and social advancement in a politically free regime, it is not certain that the same set of circumstances will be exactly reproduced elsewhere. The experience of Japan suggests that the traditional values of an agricultural society may be retained for a longer time after intense industrialization than has been the case in the Western world.[9] Colonialism may have done the same by different means, when it introduced foreign technicians and borrowed techniques, thus preventing the natural developments in social thinking which arise out of changes in the social order and which are necessary to a decline in fertility.[7] The spectre of Malthus, and of all the other bogeys of an overpopulated world, must therefore dog man's footsteps for some time to come, unless the stages in the natural cycle can be accelerated.

Limitation of the family cannot be imposed upon the human being; nor can the world community ever settle the actual numbers permissible to each nation, even if the necessary sanctions could be exercised. The hope of finding a solution to the world population problem rests upon the development of social movements, which enthrone the idea of a smaller planned family. The most natural vehicle for new teaching is public health, which not only regards the family as one of its mainstays, but also sees in overpopulation the seeds of so many of its disorders.

Every means for population control—scientifically approved and culturally acceptable—should be considered; rhythm, sheaths, diaphragms, jelly, foam tablets, oral contraceptives, intra-uterine devices, sterilization, vasectomy and salpingectomy will all play a part.[1a] Sterilization, as in India, Puerto Rico and elsewhere, and abortion, as in Japan, Sweden and Denmark may well provide the most immediate benefits and are appropriate to situations of great urgency; yet they interfere most with personal choice and increase hazards for the childbearing population. Control of the family by contraception is preferable, taught as part of maternity and child welfare, and in marriage guidance. Instruction can be given by midwives, social workers, and nurses, as in Japan, and awareness can be aroused through intensive health education of the public. The modification of public attitudes may be slow, but the means at our disposal, including wireless and television, are as great an

advance in the technological field as any in public health. Moreover, we have reached a better understanding of how to further social movements through small groups and organizations.

Limitation of families, as seen in European society, tends to have begun among professional and higher business executives, and to have spread slowly down the social gradient. The disadvantages of this, genetically and socially, are only too plain. Yet this phenomenon may well be inescapable, and it can hardly justify delay in seeking to spread an understanding of family planning. The difficulties which face the world are sociological rather than technological; they are bound with habits of living, inadequacy of housing, poverty, and systems of values – just as are so many other problems in public health.

India, China, and Japan, among those countries where the need of population control is greatest, have already embarked upon such a programme, including field experiments to determine the best technique for action and teaching. Although birth rates as a whole have altered little, yet a beginning has been made. Perhaps of greatest significance is the ready acceptance of this new teaching. The people are neither hostile nor indifferent, if perhaps a little slow to respond. A steady flow of scientific knowledge regarding contraception, and provision of facilities within the means of those wishing to adopt its practice, is urgent and will produce lasting results.[2] Much hangs on this prediction for India and the world.

Sociology can benefit from technological advance in this respect as in so many others. Technical developments in contraception, already studied over many centuries if not millenia, have in recent years given more hope of universal application. *Oral gestogens*, now taken by many millions, can be virtually 100 per cent effective[11] and *intra-uterine devices*, also used by millions, can protect '3 women out of 4'.[12] *Periodic abstinence*, based upon scientific control data, with higher rates of failure has much to offer.[13] Indeed, we are at the beginning of a movement in which science and anthropology go hand in hand to prevent man from biological suicide by over-population.

For the problems of migration, some of the answers will be found in the organized public health service, which is discussed elsewhere throughout this book. In this the medical officer of health, socially orientated and aware also of the psychological issues involved, will play an important role – as well as the general practitioner working in a team with other social workers. The health centre has much to offer.

CHAPTER 9

Occupation

OCCUPATION presented man with an early environmental hazard – perhaps the earliest, if we exclude the elements. The first arts of civilization depended upon the working of materials, which could not easily be undertaken without inhaling or ingesting harmful substances. The earth had to be mined for lead, copper, mercury, iron; the ores extracted in furnaces, and the metals worked; hides needed to be cured with alum; vegetable fibres had to be made into fabrics and these turned into garments; stone had to be dug up for building and cut to shape in the interests of art; clay had to be turned upon the potter's wheel, and glazed; simple chemicals to be compounded into paints. Where services to the public were established – once the centres of living had grown sufficiently in size – sewers had to be cleaned, bodies buried, clothing washed, and bread baked. Some occupations, which we think of as commonplace today, were slow to develop – glass making, although an early discovery attributed to the Phoenicians and known to the Egyptians, was little practised for many centuries; and it was not before 500 years of the Roman era had passed that the baker was known to ancient civilizations. Others came and went with changing customs – the purple factories, which scattered the Mediterranean seaboard, using immense quantities of the rock whelk, *Murex brandaris,* went out of fashion with the toga of the Roman patrician.

But the basic materials have differed little over many centuries, if, as in the art of making mirrors or gilding, new uses have been found for them. In all civilizations, presumably, painters have sucked lead and copper paint from their brushes, and masons have inhaled silica dust. The 'tremblings' resulting from the inhalations of mercury vapour and the paralysis which came from the ingestion of lead were probably as well known to the ancients as to Ramazzini.[10] The slaves and Christians, condemned to work in the mines, were short-lived, and so too were their successors in the Carpathian Mountains during the sixteenth century, according to the much quoted saying of Agricola in *De Re Metallica* (1556), that women were there found who had as many as seven husbands who had died

successively in the mines. The extensive use of copper and bronze in Ancient Greece for buttons, medals, money, pins, and statues exacted a heavy toll among those who worked and fashioned it. The copper miners of Greece were short-lived – old and decrepit at forty – as they were in France in 1822, when Patissier[9] wrote.

Illness arising out of occupation has also probably always had a close relationship with social status. The labouring classes have suffered from higher mortality rates, and have lived shorter lives, than those who have not needed to earn their living by the sweat of their brow, although statistical proof, for obvious reasons, has been lacking until comparatively recent times. M'Cready, in the U.S.A., in the early part of the nineteenth century, said that labourers were generally short-lived; for it was rare 'to meet with a laborer over 50 years of age', and they were generally broken down before they reached that period. In contrast professional men lived on the average over 60 years – lawyers 66, clergy 65·7, doctors 62·8, professors and teachers in schools 61 – so that in all countries those in comfortable and affluent circumstances lived longer than the labouring population.[7] In France much the same was observed in 1840 and again at the turn of the century (1907–8) when there were marked variations in death rates between employers, salaried workers, and wage workers; in the age group 35–44 deaths per 10,000 were 82, 120, and 136 respectively, and at age 45–54, 127, 203, and 232.[13] This has probably been true of all societies and not only of those industrialized countries that we have come to regard as 'developed'. Certainly with industrialization, during the last two centuries, the margin of difference between the professional classes and manual labourers was at first widened and then began to narrow.

Much of the difference depends upon living conditions – housing, diet, and economic status – rather than on occupation. Yet, perhaps the most significant differences have been within the manual trades themselves. In France (1907), the mortality of plumbers, for example, was twice that of textile workers.[13] In the Registrar General's figures for England and Wales in 1931, the standardized mortality ratio of limestone workers was 72; the ratios for sandstone workers (132), ware makers, casters, and finishers in pottery works (135), workers in metalliferous mines (134), and slate workers (168), were twice as much or more.[1] Most striking of all has been the low comparative mortality of agricultural workers. In 1931 the standardized mortality ratio for the whole group of agricultural occupations in England and Wales was 73 for males, and for those employed in tending cattle and dairying 45. The agricultural labourer has probably never

shared in the higher mortalities of manual workers generally; for angina pectoris in 1931, this class had the lowest S.M.R. of any group of workers, namely 32.[1] Small wonder that so many have extolled 'the advantage of spending days in the open air and in labours varied and good'. In 1807 data from all the hospitals in Paris showed that the mortality of occupations was greatest among the workers in the dirty trades and least among those who work in the open air, and among workers in wood and iron, and lastly among butchers, who lived among the odours of fresh meat.[9] Good living, certainly in Europe, with a balanced diet, may have accounted for some of the advantages of country living. Butchers, and the slaughtermen, their wives, and their errand boys, Thackrah noted (1831), 'almost all eat fresh cooked meat, at least twice a day – they are all plump and rosy . . . cheerful and good natured.' 'But,' he added, 'longevity is not greater in them.' They lived too highly, in Thackrah's opinion, and developed a plethora, which gradually led to disease.[12]

Modern statistics have also shown the truth of Agricola's observation that wives often do not share in the occupational risks of their husbands. Many factors enter into the hazards of the manual trades which such figures depict – dust in the air, specific poisons, accidents, excess of moisture and temperature, infections, long hours, and cramped postures.

The disadvantages certainly do not all lie with labouring, for to the hazards of the work itself must be added those of the habits of living which accompany it, habits which work engenders, but which are not necessarily part of it. While the potter has damaged his constitution through the centuries with silica dust, others who have never been subjected to such risks have done as much harm by simple neglect of physiological principles of healthy living. Thackrah's descriptions of harmful habits in Arts, Trades, and Professions were no doubt particular to the early nineteenth century when the commercial traveller, dining at the traveller's table, drank his pint or bottle of wine, then took negus with several of his customers; and at night had a glass or two of brandy and water. The result was disease: 'first an affection of stomach and head – frequently a variety of nervous and hypochondriacal feelings; subsequent congestion of the abdominal veins; finally organic disease of the liver. And if . . . not suddenly taken off by apoplexy . . . he merges into dropsy and the bloated mass sinks into an early grave.'[12] Innkeepers too were addicted to unnecessary drinking, and they ended with 'apoplexy and dropsy closing the scene', and shop-

keepers were 'too engrossed in keeping the shop, standing behind the counter all day or sitting in a small back parlour, wanting the inclination for exercise or for recreation and amusement . . . breathing an atmosphere contaminated and adulterated . . . pale, dyspeptic, and subject to affections of the head.'[12] Too many mercantile men had a disposition to have their house and warehouse within a stone's cast, so that five or six days a week they took scarcely any exercise. Of all Thackrah's perspicacious observations, those which reflect upon the importance of exercise touch most closely the weaknesses of the twentieth century. Like M'Cready in the U.S.A., he also deprecated haste at meal time:[12]

> The way in which men of business take their meals is also injurious to health. It is far too hasty. They seem to be travelling by the stage, and expecting every moment the summons of the coachman. The Arabs say, that 'he who does not care to chew his victuals hates his life'; and the adage is too often verified in this country, by the gastric disorders which result from a want of mastication.

The evils which Thackrah observed – neglect of exercise, too great concentration on the acquisition of wealth, and addiction to the pleasures of the table – are the concomitants of occupation in all cultures and all parts of the world, and probably will remain so. The present-day rise of incidence of coronary disease in developed countries, and its social gradient 'from labourer to gaffer', may reflect them.

THE GROWTH OF PUBLIC HEALTH IN OCCUPATION

Concern for the worker may well have been one of the earliest forms of public health. In Rome, public baths were available to everyone. 'The workers after having worked all day, went there in the evening to wash and to undo the fatigues of the day; they were less subject to illness than the workers of our own century'.[10] The founders of great cities and kingdoms took particular care of workmen and tradesmen. The colleges and societies of artificers, to which Plutarch refers, like the guilds of a later European civilization, helped to protect the interests of the worker. Ingenious devices, including masks to put over the mouth and nose and extraction conduits sucking out the foul vapours of the workshops, were early inventions.

Workers themselves, as Patissier remarked in 1822,[9] have been so little jealous of their health that they have disdained to surround themselves with means of preservation; it is much the same today. But the dangers of many occupations, and the heavy mortality and

distressing sickness which have followed their practice, exerted strong pressures for reform. It was the mercurial poisoning of the gilders that caused a distinguished merchant of gilded bronzes to finance research through the French Royal Academy of Sciences into the means to avoid the dangers of inhaling mercury vapour – which resulted in the *fourneau d'appel.*[9] Likewise in devising means to work the mines without the worst of risks, the inhabitants of the British Isles have often set the pace. 'The Saxons and the English, from time immemorial, the one in extracting metals, the other in mining coal, have become our masters in this type of improvement'.[9] We have little means now of knowing how effective were the measures of protection in the mines and workshops, and other dangerous occupations, throughout the centuries. There was, no doubt, a growth of technical knowledge, which was practised with varying thoroughness by enlightened employers and intelligent workmen.

Occupational disease has been a challenge to medicine, but only in relatively recent years. Bernardino Ramazzini was the first to throw down the gauntlet, when in the preface to his account, *The Diseases of Artificers* (1700), he wrote:[10]

> Must we not in fact agree that many occupations are a danger to those who engage in them, and that the unhappy workers who fall ill when they looked to be able to support themselves and their families, die cursing a thankless job. . . . It is but reasonable that medicine should contribute its share for the benefit and comfort of those for whom the law has been so tenderly careful, and display itself in a particular manner (a thing hitherto neglected) for the safety of tradesmen, that they may follow trades without injuring their health.

Medicine has since displayed itself to good effect. Doctors, in the quiet of the study and by painstaking observations in the field, have examined the dangers of following various trades. Mortality statistics have done much to compel attention. As Patissier sagely observed:

> When it has been established that the procedure in some occupations occasions great mortality . . . government will appeal to the learned and require them to modify the work or discover a healthier form. Doctors, for their part, will point means to preserve health . . . then, too, we will have the possibility of advising children about the choice of a profession according to their constitution, physique, temperament, and disposition.[9]

Patissier, like Ramazzini, who 'thought it no indecency to step some times into the meaner Sorts of Workhouses, and View the Secrets of Mechanic Arts',[10] may have been hitching his waggon to a star; but these early pioneers were helping to set our thoughts in the direction of world health. Many have followed in their footsteps,

through the workshops of Europe and the New World. Greenhow's pilgrimage through the factories and workshops of England, 160 years after Ramazzini, examined the effects of industrialization in causing pulmonary disease in a wide range of occupations. Greenhow indicted dust:[3]

> Grinders of cutlery, needles, and other steel articles; miners, quarrymen, stone masons, china scourers; potters, turners of earthenware, makers of plaster-of-Paris moulds, hacklers of flax and Mexican fibre; sorters of wool, alpaca, and mohair; operatives employed in the manufacture of waste silk, and in the carding-rooms of cotton factories; wool-combers; workers in bone, ivory, horn, and mother-of-pearl, and makers of walking-sticks and wooden handles for cutlery, umbrellas, and parasols.

In all these trades, the atmosphere became loaded with fine dust of metal, stone, clay, soot, flax, or woollen fibre. In mining and wool-combing, flat-pressing, and in the potteries, there was damage to the lungs by inhaling fumes and from an over-heated and highly dried atmosphere.

Hot and exceedingly moist atmospheres, ill-ventilated and over-heated factory rooms, extreme of temperature, stooping and constrained postures, long-continued sedentary work, and ill-ventilated and over-crowded rooms, all played a part in pulmonary disease. This added many more trades: straw-plaiting, silk-piercing, glove-making; slip-making, and flax-spinning; lathe-making; decorating and 'throwing' of earthenware; welting and finishing of hosiery.

What occupations remained to which men might engage without the danger or likelihood of succumbing to pulmonary disease? The risk certainly was high. The mortality from pulmonary diseases among the male inhabitants of Sheffield (1848–54) was an average rate of 8·39 per thousand – and this at a time when the use of fans to suck away the dust had been widely adopted. But as Greenhow so acutely observed:[3]

> Although the introduction of fans has produced such beneficial effects, the occupation of needle pointing is still attended with injury to health. A small quantity of fine dust, only perceptible when the sun shines brightly, escapes the indraught of air . . .

For 250 years, doctors in Europe and the New World have sought to unravel the tangled skein of disease in industry by the study of industrial processes, the workshops in which they occur, and the workers themselves. But the truths about occupational hazards, although they stimulated interest, provided no automatic remedy – it still remained to apply them to the vast and ramifying industrial patterns of rapidly expanding societies; and without public health organization there was little chance of enforcing measures of protec-

tion. Patissier[9] asked that occupations which were a danger to health should be prohibited; that dangers be diminished by machinery to supplement manual labour and prevent gases and vapours from poisoning the environment; that public baths be established as in Roman times; and that those who were injured and whose health was damaged by occupation should be helped by the State and by insurance schemes. It was a beginning. Systems of factory inspection, notification of industrial diseases, special rules for dangerous industries, medical supervision of workers, institutes of hygiene, and public health action of all kinds have grown from it.

Thus, largely as a result of Ramazzini, M'Cready, Patissier, Thackrah, Greenhow, and others – a small team of medical pioneers – the industrial workers became the first of the so-called vulnerable groups to be the subject of organized public health, when Europe and America, in the middle of the last century, took the first hesitant steps in the supervision of the factory worker's health – France sending circulars to the *Préfets* in the *départements* (see Chapter 14) and England appointing factory inspectors under the Shaftesbury Factory Act (1833). An early step was the medical examination of new entrants to industry and the exclusion of women and young children from the mines. Provisions for ensuring safety and a reasonable working environment – cubic capacity per head, temperature, humidity, ventilation, sanitation – and regulations covering dangerous trades, have required special codes and systems of inspection by skilled technicians in a wide range of ever changing processes. Increasingly the industrial health service has been concerned with problems in social medicine – the psychological and social problems of the worker (see Chapter 13).

In these developments doctors have played a large part both in central government departments and locally. Nationalized industries in Britain and elsewhere have provided their own medical service. Large private industrial concerns have appointed whole-time medical officers with the duty to advise on all matters affecting the health of the worker, to study sickness, absenteeism, and industrial disease, to examine workers for occupational risks, to carry out periodic health checks, and to educate the worker in health matters. In the U.K. by 1950 nearly 5,000 factories had provided their own health service.[1] In Russia, industrial health is supervised by public health doctors working from the industrial policlinics (health centres); a high proportion of workers in industry are given annual health checks by a team of policlinic specialists (see p. 151).

The problems of factory health, particularly in old industrial

societies, are complicated by the large number of small factories for which so far it has not been possible to organize the same measure of health cover. In the U.K., of some 250,000 factories and workshops, four-fifths have less than 26 workers; only 12,000 have more than 100, and less than 5,000 more than 250 workers. The small factory has much to offer in sympathetic management – of importance to psychological and social health – but it often lacks much in the hygiene of the environment.

For occupational health outside the factory – in shops and offices, hotels, catering establishments, the house, and the professions, much less has been done. The protection of health for these occupations will depend upon further research into the risks involved – into coronary disease, for instance, which affects most of the professional classes, particularly doctors and business executives.

THE FUTURE OF OCCUPATIONAL HEALTH

Throughout the industrialized countries, hazards to health in factory life have been much reduced, particularly those due to inhalation of dust through the introduction of mechanical devices to draw away the dust or to prevent it from rising; so that wherever organized public health operates successfully, the dusty occupations have lost most of their terrors. No longer can we point at the metal filers, where no instance was known, in 1833, of a working filer exceeding the age of 50; nor to the mason whose 'chippings from the stone occasioned serious and often fatal injury of the lung'; nor to the lead miners who 'rarely work more than six hours a day, yet . . . seldom attain the age of 40'; nor to the fork grinders 'who use a dry grindstone and die at the ages of 28 or 32.[12]

The workers into whose systems poisons have entered by other means, manufacturers of lead and painters 'sallow and thin' and 'soon broken in health',[12] and paper stainers, poisoned by arsenic or white lead, have been protected, following the discovery of substitutes and the prohibition of materials. But new discoveries continually introduce new hazards. The manufacture of new chemicals has already done so on many occasions. Many of the newer metals, for example, cadmium, platinum, and beryllium, have proved harmful when absorbed into the body, and their use has given rise to new dangerous trades, such as the coating of tubes for fluorescent strip lamps with beryllium compounds, the smelting of cadmium ores, and the welding of its alloys.[5 6] White phosphorus gave mankind the inestimable advantage of a 'strike anywhere'

match, and the terrible malady of 'phossy jaw'. Phosphorus poisoning, of which the first case was reported in Vienna in 1838, was finally rendered unnecessary when a satisfactory substitute in sesqui-sulphide of phosphorus was put into operation in France in 1898.[5 6] Chronic benzine poisoning, taking the form of aplastic anaemia, is more recent; and, since benzine is used as a solvent in great quantities, and in a variety of industries, it remains a danger.[5 6]

Arsenite of copper, named 'Scheele's green' after its discoverer, began to be used extensively in the middle of the nineteenth century in colour printing and in the preparation of ornamental wrapping paper, wallpapers, and artificial flowers. The arsenic poisoning which resulted was brought to public notice by one of the first medical officers of health (Dr Hillier in the Parish of St Pancras, London), and the study of its disastrous effects upon the health of this new occupational group was brilliantly undertaken by Dr Augustus Guy, one of the earliest epidemiologists to use statistical methods.[4] Now that aniline dyes have displaced Scheele's green as a colouring matter, paper and flower making is no longer hazardous, but arsenite of copper is still manufactured as an insecticide for preserving fruit trees; and it is an ingredient of sheep dip. More recently it has come under suspicion as a cause of epitheliomatous ulceration in those engaged in its manufacture. The twentieth century has introduced the hazard of radiation – in mines, factories, and medical work. Various occupations add small numbers to the swelling total of lung cancer (see p. 42).

New hazards come and others go with the changing patterns of life. The chimney-sweep with his cancer of the scrotum is no longer seen; but other occupations have had the same effect (see p. 42). The cattle driver who walked '20, 30, or 40 miles a day' and the gentleman's coachman who 'filled up his time by filling up his stomach' were specific to an age now past.[12] The chaise drivers, postillions, stage coachmen, and guards of coaches who suffered from 'irregular living and the habits of frequent potation' have come and gone.[12] But the hazards to which they were subjected may well have been no more than that of the long-distance lorry drivers today. For many, the risks of unphysiological living, particularly lack of exercise, have increased with changing customs. The commercial travellers are no longer 'riding from town to town' as in 1831, nor does the practice of medicine and surgery today require 'that a considerable portion of time be daily devoted to study and the rest to professional visits . . . which afford exercise in the open air, and thus tend to invigorate health'.[12] Whatever was the virtue of

travelling by horse in the open air has gone; and for it is substituted travel by motor car, whose hazards are not yet fully understood.

Thus, occupation remains one of the main hazards to health throughout the world; it leaves no room for complacency. In the form of industrial accidents it is a major cause of incapacity – among roughly 20 million insured workers in England and Wales during 1961/62 accidents caused nearly $\frac{3}{4}$ million spells off work. Accidents in mining and quarrying, as from time immemorial, constitute a particular danger. They accounted for over a third of the total, and, when taken together with accidents in the engineering trade, for about half the total of spells off work of all the working population.[8]

In many occupations, such as coal mining and working in the carding rooms of mills, dust is still causing illness, although it is less immediately obvious than that produced by mercury, lead, and copper. We still find that bronchitis of the flaxman, which Thackrah described so meticulously, and which was re-discovered 125 years later.[11] Many occupations, such as tailoring, shoe-making, or laundry work, are still carried on under harmful conditions, although without any specific or noxious agent involved. The cross-legged tailor, of whom Thackrah wrote, 'his body bent for thirteen hours a day' and 'sitting all day in a confined atmosphere'[12] is still to be found in all too many parts of the world. Jewellers and workers in gold confined 'to a leaning posture, with the head much depressed and the elbows generally forced to the sides of the trunk, for ten, fourteen, or sixteen hours a day'[12] are not entirely unknown. Stone masons, as in Jordan, tap endlessly, like woodpeckers, and inhale siliceous dust. There remain many occupations where the temperature and moisture, and most recently noise, is excessive. All such occupations can only be made healthy if the State demands it and the citizens believe in it.

The road to health in and through occupation, with no end in sight and with constant changes of direction, has been long and tedious. All nations travelling along it are driven at different paces, but inexorably, by the increasing demands of technical development. The protection of the worker as a vulnerable group in society – with supervision of his environment and of the effects of technical processes upon him mentally and physically – is therefore sound public health. Such public health measures may be based upon institutes of hygiene as in Yugoslavia or upon health centres as in Russia; they may be part of a health unit as in France or an independent service as in Britain. The organization must suit the circumstances and philosophy of each nation. But for all, irrespective of the details of

the plan adopted, greatest advantage will come through the integration of occupational health with other public health work and with the general medical care of the worker in his home setting.[1]

Finally, occupation is an essential ingredient of health. Since man is a social animal, he must have an object in life, otherwise 'he is like a tree without a leading shoot' – he dissipates his strength in irregular pursuits or decays from listlessness. Man's difficulty has been to seize the benefits of occupation without taking on its dangers. Work in itself should not cause illness, but rather health. As M'Cready said:[7]

> In reviewing the various employments by which man obtains his bread by the sweat of his brow, we are struck by the fact that various as is their nature, there is nothing in the great majority of them which is not compatible with health and longevity.

CHAPTER 10

Town Life

MAN'S desire, as a social animal, to play his part in groups has exerted an important influence on public health. When man was a forest or cave dweller, thinly scattered across the surface of the globe, we can be certain that, although he had much to withstand, there were many dangers that we have since endured of which he knew little or nothing. In leaving behind his nomadic life – perhaps in the neolithic period – to live in villages, his epidemiological history began afresh. The web of his social obligations was woven into new patterns, his environment developed new hazards, and his long battle with bacteria began in earnest. Then came the towns, 'a living personality, expressing and cherishing the instincts, tastes, beliefs, and corporate pride of the citizens, widely and richly pictured'[5] and, of course, bringing with it fresh hazards as well as new opportunities for health. What has been the influence of the town upon world public health? Has it improved health or worsened it? Has man seized the new opportunities or fallen prey to the hazards?

The shattering epidemics, which have smitten cities during the past twenty-five centuries, and of which the memories live with us for their effect upon history, such as the plague in Athens in 430 B.C., of which Thucydides told, or the pestilence of A.D. 543 which Gibbon reconstructed, are to be accounted, but not too seriously judged.

They may well have been isolated events. For the health of a town we should look equally, if not more, to the long intervening years and to the diseases which prevail at all times. As John Graunt (1662) said:[4]

> Upon the proportion of chronical diseases seems to hang the judgement of the fitness of the country for long life . . . in countries subject to great epidemical sweeps men may live very long, but where the proportion of chronical distempers is great, it is not likely to be so . . .

The extent of the 'chronical' disorders, as a measure of the balance between good and ill, is, of course denied us. Until late in the sixteenth century when the Bills of Mortality began to be kept in London, there was little to go upon except descriptive writing and archaeological remains.

The early civilizations in Crete, Egypt, Greece, and Rome, all at some time, if not immediately, designed and built model towns – clean and spacious with pure water supplies and well sewered. The latrine and the flush closet were invented, not as some have said during the European Renaissance, but in Crete, perhaps 3,000 B.C. or earlier. No sight is more remarkable than that of the waterpipes and sewers, still intact in the foundations of the Aesculapian hospital where Galen once walked at the foot of the acropolis of Pergamum, with the modern city, lying adjacent, devoid of sanitation. The cities of Rome and Greece had internal heating to their houses by means of the hot-air system and their city dwellers may well have enjoyed a greater measure of comfort than at any time until the nineteenth century was well advanced.

The ancients practised hygiene in the sense of basic sanitation in their cities, as assiduously as Edwin Chadwick was to do in those of Britain two millennia later – and probably with as little understanding of its basic principles. Galen knew that phthisis was contagious. Avicenna, a thousand years later, in his *Qanun*, is said to have recognized the spread of disease by water.[7] But did the Greeks and Romans understand, or even suspect, that infections might be water-borne? More probably they were influenced by aesthetic considerations.

Hygienic practices, which in any event may not have been universal or even general, in ancient Rome and Greece and in the Arabian and other civilizations, are not likely to have been wholly satisfactory – with the ever present risks of contamination of food and water. We ourselves in the twentieth century with all our scientific understanding have prevented the worst of the water-borne diseases for only about one-eighth of the world's population. Without any exact

understanding of the mode of transmission, it is more likely that the ancient civilizations suffered considerably from water-borne diseases.

Most ancient cities – once they had outgrown their early lay-out – seem also to have harboured slums, so that the poor, not to mention the slaves, may well have lived in overcrowded and unhealthy quarters.[18] We need to look behind the Greek cult of physical fitness, the public amenities, sun-bathing, soap factories, and aqueducts of ancient Rome. Ramazzini, quoting Lucilius, paints a dismal picture of the slaves occupied day and night in the baths – subject to many ills, dropsy, ulcers, abscesses – pale, sad, puffed-up, cachetic, and often attacked by the maladies of those upon whom they attended (see Chapter 9, ref. 10). The life-expectancy, calculated from burial inscriptions, of about thirty years (400 B.C.), certainly supports the belief that there were many adverse influences at work.[17]

When the barbarian hordes swamped the Roman Empire and the Goddess Hygeia suffered the fate of other deities, town life for most of the European continent became increasingly inimical to health. But the Islamic civilization continued and extended the hygienic practices of Rome and Greece, adding to the understanding of contagion by descriptions of smallpox, anthrax, measles, and scabies. Hospitals became centres of learning, and medical schools, under such men as Al-Majusi, taught that the first art of medicine is keeping health in the healthy. The cult of personal hygiene occupied large sections of their many textbooks. Cities employed sanitary inspectors to have oversight of the preparation of food.[7]

But, as with the Greeks, the towns must have carried many risks which only a deeper understanding of bacteriology could have avoided. The running water from the River Tigris, introduced into each department of the Adudi Hospital built at Bagdad in A.D. 981, may well have been heavily polluted. Elsewhere in Europe, with the exception of Spain, the world no longer practised the art of sanitation. The aqueducts lay in ruins and the massive drains remained with the foundations of the cities for later generations to unearth. The opportunities for health which the town provided were ignored, and the hazards mounted.

This state of affairs is said by many historians to have continued until relatively recent times. Shattuck, writing his report of the Sanitary Commission of Massachusetts in 1850, said:[15]

> It does not appear that any sanitary regulations existed from the seventh to the fourteenth centuries. In those dark ages people lived without rule of any kind; and consequently frightful epidemics often appeared to desolate the land. Although so ancient, few subjects have since made so slow and so little progress, as the science of public health.

Not everyone can agree with Shattuck about medieval Europe. The medieval city had much to commend it. It was small and circumscribed and set in a countryside to which everyone had easy access. There were gardens and open spaces, municipal baths, hospitals, and often water pumped from the river in wooden conduits. Here, where 'if the ear was stirred the eye was even more delighted', townsmen took joy in their civic life.[9] Overcrowding and the horrors of insanitation have been a later development, dating from the sixteenth or even early seventeenth century, when the call of the town and the increase of the population generally began to have its effect, and when open spaces were built upon, the shallow wells became polluted by seepage and 'the pestilential heapings of human beings' began.[14]

The New World waited until the nineteenth century before towns passed the medieval stage. In the early eighteenth century the Americans were of constitutions so sound and robust as to be rarely exposed to the shocks of any disorder.[6] A century later M'Cready commented that his countrymen had so far enjoyed 'good and peculiar advantages'. But he went on to doubt whether this could continue with 'the increased size of towns, the diminished price of labor or fluctuations in demand for it . . .'.[8]

Nevertheless, it is likely that the balance of disease has been against the town in all stages of its development, with few exceptions throughout history. Towns have tended to relax restraints on conduct and have tempted to excesses harmful to health. They have fostered prostitution, spreading gonorrhoea, at least, in the centuries before the world pandemic of syphilis. They have encouraged alcoholism. In the seventeenth century, London's half million people drank $1\frac{1}{2}$ million barrels of beer, or 3 barrels per head, per annum.[1] This may well be a near record. But if not one thing, it was usually another. Rickets, which John Graunt did not find 'among the casualties' in the Bills of Mortality until 1634,[4] and no doubt bronchitis, have been the plagues of London – ever since the sea coal came down from Newcastle in quantities sufficient for its foul fumes to blot out the sun and fill the lungs. The inhabitants of seventeenth-century London were highly subject to 'stuffings of the Head, Hoarseness, Coughs'.[6] Rickets began to flourish in the country town of Hallamshire in South Yorkshire, later to be the steel city of Sheffield, as it did in London under the smoke pall that the new iron furnaces produced. Hippocrates is said never to have mentioned atmospheric pollution. But in the sunshine and clear atmosphere of Rome and many other Mediterranean cities, which never knew smog, there

was malaria. Towns have also had their occupational hazards. The metal-men whom John Graunt described – 'men being long sick, and always sickly' – were town dwellers.[4] However gracious we may suppose the medieval town to have been in its outward form, it is certain that the workers in ill-lighted and ill-ventilated workshops of Europe died earlier and suffered more than their contemporaries on the land.

Much will have depended on their geographical situations. The citizens of all the northern towns, as they outgrew their slender vegetable supplies, will have been generally on the verge of scurvy, a disease which must have been unknown to the Mediterranean civilizations. Rome was unhealthy because of malaria, and 'in Hispania, Lusitania, and Cisalpine Gaul the expectation of life was far higher than in the capital'.[3] Carthage in North Africa, besides enjoying 6 million gallons a day of pure water through an aqueduct built in Hadrian's time, was situated in a dry desert air, altogether free from malaria.[3] The confederation of city states of Pamphylia, now Antalya, in Southern Turkey, lapped by the waves of the Eastern Mediterranean, cannot have suffered the half of the 'chronical diseases' of the Londinium of Roman and Saxon times.

The extent of the ill-health occasioned by town living began to be studied scientifically only in the seventeenth century. Since Captain John Graunt, F.R.S., wrote his *Natural and Political Observations on the Mortality* (1662), towns have generally been regarded as places of higher mortality. As Graunt pointedly said of London:[4]

> As for unhealthiness, it may well be supposed that although seasoned bodies may, and do, live near as long in London as elsewhere, yet new-comers and children do not; for the smoaks, stinks, and close air, are less healthful than that of the country.

The Parish Clerks' Bills of Mortality, in fact, show clearly that from 1593 to the year 1800, i.e. over 207 years, the deaths invariably exceeded the births, and often to an enormous extent, the maximum being reached in the memorable year 1665, when the deaths were 87,339 as against 9,967 births. Between 1603 and 1644 there were 363,935 burials and 330,747 christenings. Throughout the eighteenth century, deaths exceeded births by 6,000 a year or in total by 600,000 for the century. Only the steady migration from country to town, supported by the higher birth rates of village life, sustained the City of London and caused it to grow.

> The streets were filthy without, the houses filthy within. The rooms of the poor were more like pigstyes than human habitations, unventilated, and strewn with rushes, which were seldom changed; and the wretched inhabitants closely packed in these miserable hovels must have become very prone to

suffer from infections of all kinds . . . There were no underground drains, and the soil of the town was soaked with the filth of centuries.

This description[11] would have applied widely throughout Europe in the fifteenth, sixteenth, and seventeenth centuries and, with modifications to suit the centuries, cities everywhere in course of rapid growth. Thus M'Cready describes New York in 1836:[8]

One great source of ill-health among laborers and their families is the confined and miserable apartments in which they are lodged. In the rapid growth of our city (New York) in particular, the number of buildings has by no means increased in a manner corresponding to the great influx of strangers . . . large buildings . . . have been divided into numerous small, dark rooms, every one of which is tenanted by a family . . . narrow alleys with small wooden tenements, which costing but little, and being let to numerous families, yield immense profits. The alley is often not more than six feet wide . . . apartments . . . underground.

So it is with much of the world today. Hostages are thus given to fortune.

The factors which produce disease and death in town life, poverty, insanitation, occupation, habits of life, atmospheric pollution, etc., are not easily distinguishable one from another. Yet each can be individually considered and remedied. Poverty, for example, can be distinguished, as Edwin Chadwick said in the report of the Royal Commission into the State of Large Towns and Populous Districts in England and Wales, 1845:[13]

It is too commonly supposed that the evils above adverted to are the inseparable concomitants of poverty; and doubtless, so long as the inhabitants of the most neglected and filthy abodes in crowded cities are unable to provide for themselves better and healthier dwellings, sufficient light and air, more open situation, effective cleansing and drainage, and adequate supplies of water, their vigour and health are undermined, and their lives shortened by the deleterious external influences consequent upon the want of efficient arrangements for securing the above objects.

High mortalities and excessive disease continued to prevail throughout Europe and the New World until well into the nineteenth century.[17] All was not due to the insanitary state of the towns, but much was. Estimates of life expectancy in various European towns between the thirteenth and seventeenth centuries ranged from 20 to 40 years; for example, in Geneva, it was 21 years in 1561–1600 and 28 years in 1601–1700, and in Breslau 33·5 years in 1687–91. The expectation of life at birth of the Swedish population as a whole in 1755–76 was only 33–40 years.

The mortality rates prior to the twentieth century were everywhere greater in the cities than in the country. Thus in Brandenburg (1739–48) the crude death rate was about 25 per 1,000 in rural areas,

31 in small cities, and 36 in larger cities like Berlin. In Stockholm, 1755–76, life expectancy at birth was about 14 for males and 18 for females; while the figures for all Sweden were 33 and 36 respectively. In the United States, in 1830, mortality conditions were far worse in the large cities than in small cities and rural areas. In Glasgow in 1837 the death rate was 41, of which 8·6 was due to 'fever'.[2]

But gradually, as Europe and the New World have developed, the rates of mortality for town and country have approximated. Social reforms, environment sanitation, rising economic levels, and the application of new knowledge to public health practice have all played a part. The reported death rate for Vienna (24 per 1,000) was already below that for Austria as a whole (29 per 1,000) before the end of the century (1886–90). In Sweden the death rates of urban areas have been below those of country since 1911–15. Infant mortality in Swedish towns fell below those of the country for the decade 1920–30, and in the U.S.A. in 1930.[16] Around 1910, males in Zurich could expect to live 1·7 years longer than all Swiss males. Finally, among 26 countries in 1948 and 1949 for which crude death rates appear in WHO publications, the principal cities had lower rates in 10 and equal rates in 3.[17]

In most of the towns of Central European countries and in the United States of America, the infant mortality is now lower than in rural districts. Among the more advanced countries, Britain, except for London, remains partly an exception to this rule; here the chief excess begins after the neonatal period, when the adverse influences of the environment come into play. Town dwellers after 'childhood', however, have age-specific mortalities higher than in country districts – particularly after 45 years, when atheroma and chronic bronchitis, much less prevalent among country dwellers and particularly agricultural workers – begin to have their main effect (see p. 41). The excess of degenerative disease, aided by pollution of the atmosphere and the more sedentary life, is likely to grow with the ageing of the population.

But towns are an important influence mentally and socially, as well as physically – and in these they have much to cause misgiving. Overcrowding, house sharing, lack of household amenities, are severe handicaps to mental and social health – straining family relationships and adding to neurosis by psychosomatic diseases. In 1951 Britain, after 6 million new houses had been built in 30 years, had 3 million households, holding 13½ million people, living at an average of more than one person per room – the maximum for healthy living prescribed by the Royal Commission on Population;[12]

nearly 60 thousand households lived at more than 3 per room. Over 2 million dwellings were shared between two families, including the high proportion, up to 75 per cent in one city (Aberdeen), of mothers having a first baby – a situation giving rise to worry, unhappiness, and insecurity. One in five households were without exclusive use of a water-closet and twice this number had no exclusive use of a fixed bath; one in ten were without exclusive use of both kitchen sink and stove. For many in such conditions in the slums of Europe and the New World, in the middle of the twentieth century, the term 'living' is an exaggeration. The effects of the ill-considered building of the Industrial Revolution and its aftermath have not been easy to eradicate – particularly when the idea of what a good home should include has steadily advanced. To think in terms of persons per room is often to ignore the meaning of family life. The modern prescription for a home includes good insulation, space heating, and a room for the children to study in, as well as internal plumbing, sanitary conveniences, bathrooms, and technical aids to housework from food mixers to clothes washers; except for the older folk and single workers a minimum of three bedrooms is needed. In an attempt to escape from the outworn environment of the industrial towns Europe and America have spread out in successive overspills into the countryside – leaving large areas in the centres of the towns culturally desolate and dead. The question which William Cobbett (1762–1835) asked, 'What is to be the fate of the greatest wen (London) of all?' (*Rural Rides*), might now be applied widely to the towns of the developed world.

Town living altered little in extent during many centuries, when the world's population grew only slowly (see Chapter 8). Ancient civilizations had relatively greater concentrations than anything today – perhaps a million people lived in a dozen or more cities of antiquity, Nineveh, Babylon, Memphis, Thebes – but then and later the bulk of the people were rural dwellers.[18] Europe, too, was mainly rural throughout the Middle Ages – when, moreover, towns were also small; London in the fourteenth century contained only 35 thousand people. But from the sixteenth century in England, and in the rest of Europe from the eighteenth century, or at varying times during the nineteenth century, there has been a steady growth of urbanization.[18]

It is difficult to compare urban living because of the varying definition of a town; in some countries this is determined by arbitrary administrative divisions, whereas in others it depends on size with varying lower limits. On the basis of two thousand

inhabitants as the lowest level, Britain, a hundred years ago, was over 50 per cent urban-dwelling, while France (26), Denmark (21), U.S.A. (15), Norway (12), Sweden (10), were mainly rural. Today Western Europe, North America, and Oceania are predominantly urban – Britain 81, Australia 69, Denmark 67, North America 63, New Zealand 61, France 53, Sweden 56, Norway 50; while the countries of Asia, Africa, and much of South America are mainly rural – Nigeria 8, Ceylon 15, India 17, Colombia 29, Turkey 25, Japan 38.[16]

The growth of towns in many parts of the world is now proceeding fast. The annual rate of change in recent years has been in Egypt 1·79 per cent, in Venezuela 2·75 per cent, and in the Union of South Africa 3·16 per cent, as compared with England and Wales where the rate of increase has fallen to 0·04 per cent. Outside the developed world, people are crowding into the towns, often to live in circumstances of great discomfort and dangerous congestion and adding to the problems of public health in countries that already have too many. Here they are reproducing again the effects of industrialization from which Europe and the New World have only recently escaped. What can be said of the cities and towns that now abound where it is not a question of one person or even one family to a room, but of many families and even a family per bed space, without water or sanitation? As the Hammonds said of England when the Industrial Revolution had done its worst, 'the idea of the town as a focus for civilization, a centre where the emancipating and enlightening influences of the time can act rapidly and with effect, the school of social arts, the nursery of social enterprise, the witness to beauty and order and freedom that men can bring into their lives, had vanished from all minds'.[5]

The Industrial Revolution has left the world with a legacy of outworn towns, sprawling suburbs, and disfigured countryside. The towns of Europe no longer stir the ear and delight the eye; they have been dragged at the heels of the giant industry during two centries of agony. Physically now more healthy, except for their smoke clouds and fumes, they have lost their identity, ever sprawling farther into the countryside. As industrialization spreads throughout the rest of the world, towns everywhere may well have to undergo the same trial. Yet the world needs good towns. The town should be a pleasant place in which to live and a joy to visit; it should shelter the good life, making social activities easier and cultivating the arts. It should be a centre of intellectual stimulus and a place where the products of organized effort and combined

wealth increase the pleasures of the senses – and where public health has not only removed the hazards but increased the possibilities of health. Once again it is to public health that the world must look for a lead.

CHAPTER 11

Hospitals

HERODOTUS may well have been misinformed, as Sigerist suggests,[19] when he made a statement that has rung down the ages, that the Babylonians lacked physicians. The sick were placed in the market-place to have the benefit of the observations of all passers-by; but physicians there were, although probably many less than in Egypt, where there was so much specialization. As we read in the Odyssey,[16] 'In medical knowledge, the Egyptian leaves the rest of the world behind'. The blending of magic with reason, of knowledge with faith, and of physician with priest, inevitably associated the care of the sick with the Temple. To the Temple no doubt the medical school was attached; and here sometimes the sick were brought to be laid reverently in the care of the Gods.[17] The Aesculapian temples, of which some 200 were built throughout Greece and Asia Minor in the thousand years that followed upon the first at Epidaurus in 1200 B.C., had something of the flavour of hospital care. Buddhism, like Christianity later, stimulated humanitarian feelings for the sick and suffering. Under the great emperor Asoka, from about 260 B.C., Buddhist hospitals were established throughout India and Ceylon. But the Far Eastern hospital including institutions then arising in China, resembled the hospice of our own monasteries. Fa-Hsian, the Chinese monk who visited India and Ceylon during the years A.D. 399–413, said, 'The poor, the orphans, the lame, in short all the sick of the provinces repair to these houses, where they receive all that is necessary for their wants.'[7]

They were perhaps better described, as in A.D. 629–45, by another Chinese pilgrim to India, Hiuen-Tsiang, as Houses of Benevolence.[7] The Roman valetudinaria, although more truly hospitals for the sick and wounded, were military establishments attached to the camps of the legionaries.

The word hospital has clearly changed its meaning, with the growth of ideas, from a place of refuge to a centre of skilled medical care.[8] In the form of which we think of them today, the Arabian hospital may have been first in the field. Islam built hospitals specially designed for medical treatment from Bokhara to Seville after A.D. 750. As Khairallah[12] has said:

> Every patient who needed hospital care was admitted, with no reference to colour, creed, sex, or social status. . . . Each hospital was divided into two main sections, one for men and one for women. Each section was then subdivided into wards and rooms for internal medicine, diseases of the eye, surgery, and orthopaedics. The medical section was further subdivided into wards and rooms for fevers, wards for cases of diarrhoea, and special wards with barred windows for the care of the mentally afflicted and insane.

Arabian hospitals were certainly more in keeping with modern ideas than those which began to be founded by Religious Orders in Europe about A.D. 1200, although according to Mumford,[14] the medieval town was by the fifteenth century well supplied with hospital beds at the rate of one to every 2,000 inhabitants. Leprosaria, which began in ancient Rome, to protect the community, were widely used in the Islamic civilization before being adopted by Europe in the Middle Ages.

There were, of course, good reasons why the sick should not have been gathered together for treatment. The art of scientific diagnosis and of surgical and medical treatment generally was lacking. Nursing care was better in the home. For those not in the immediate vicinity of a centre of culture there was the problem of transport. But more important than these reasons was the increased danger. Hospital care provides unusually good opportunities for the spread of infection, to which our language has given poignant testimony. Hospital-fever betokened 'a kind of typhus fever arising in crowded hospitals from the poisonous atmosphere'; and hospital-gangrene, 'a spreading sloughing gangrenous inflammation starting in a wound and arising in crowded hospitals'. The description of the Hôtel-Dieu in Paris by Tenon[21] in 1788 in which he said that '*Quatre et six couchent dans le même lit*', makes gruesome reading, even more that by Max Nordau,[11] who wrote:

> On the same couch, body against body, a woman groaned in the pangs of labor, a nursing infant writhed in convulsions, a typhus patient burned in the delirium of fever, a consumptive coughed his hollow cough, and a victim of some disease of the skin tore with furious nails his infernally itching integument. . . .

Although hospitals will not always have fallen into such evil

practices, they are likely always to have been dangerous. Writing of the much vaunted Islamic hospitals, Elgood[9] says:

> In spite of this apparently elaborate organization the hospitals were not popular. I have nowhere come across in Persian or Arabic writers any eulogy, such as modern patients so often give when they are discharged. On the contrary it was generally considered a very grave misfortune to be taken into hospital and kept there.

As the merchant in the story of Ganem in the Arabian Nights[9] said: 'I will gain Paradise by means of this poor person; for if they take him into hospital they will kill him in one day'. The dangers increased with the growth of population in the Western world when hospitals became more and more overcrowded and the practice of sleeping several in a bed was commonplace. They were aggravated by lack of professional nursing. As late as 1848 in Charing Cross Hospital, London, according to Lord Inman, a benefactor and governor of the hospital, nursing was done by 'watchers' paid 5*s* a week living out; patients were admitted on one day a week, often to beds just vacated by fever cases, and bed linen was changed when worn out.[4] Thus it is that hospitals, the centres of healing and sources of professional and intellectual aid, as we think of them today, are largely new to man. They were made possible by Pasteur, Lister, and Florence Nightingale, in the middle of the last century. The twentieth century had dawned before the hospital began to occupy the centre of the medical stage.

The growth of the hospital, and its remarkable transformation with the discoveries of the last century, are important to our understanding of world public health. Public Health began in Europe and the New World before the era of asepsis. When Edwin Chadwick (1800–90) started his life work in the 1830s, Florence Nightingale (1820–1910) was only just beginning to think of nursing as a profession, and the work of Louis Pasteur (1822–95) and Joseph Lister (1827–1912) had all to be done. Hospitals continued to occupy a relatively lowly position in public esteem, as places in which to segregate those who were a danger to public health, or an inconvenience – the sick poor in workhouse infirmaries; the lunatics in asylums; and the infectious in fever hospitals. As places for treating sickness, apart from quarantine or incarceration, hospitals differed little from their predecessors for many centuries. No one then looked to them as more than a limited answer to problems of public health. In her *Notes on Nursing* (1858)[15] Florence Nightingale spoke of the need to teach people how to live. The remedies, she said, for the enormous child mortality are well

known 'and among them is certainly not the establishment of a child's hospital'.[15]

The thoughts of the medical profession were then centred upon problems of health and disease throughout the community – how infections spread; what steps to take to prevent illness in industry; the importance of diet, housing, and habits of living. The records of the Epidemiological Society in London in 1850 contain the names of physicians and surgeons of great eminence. T. Spencer Wells (1818–97) read a paper on 'Technical Results of Quarantine' a quarter of a century before he became Hunterian Professor of Surgery and Pathology; T. Clifford Allbutt (1836–1925) spoke 'On the Prevention of Disease by Reconstruction of the Dwellings of the Poor' a long time before he became Regius Professor of Physic at Cambridge. The nineteenth-century doctors passed easily from the study of the individual to that of the community. Men with the outlook of John Snow or William Budd, M'Cready, Thackrah, Greenhow, and Patissier were not difficult to find.

The world today is wedded to the hospital. In the developed and under-developed countries alike, where there is nationalization and where there is none, with and without social security, hospitals are being built everywhere on a large scale (see Chapter 15). In fifty years the hospital has come to dominate the medical scene. It absorbs the best of the brains of the medical world, the lion's share of time and effort, and, of course, money. Medical students and nurses, who receive nearly the whole of their training within the four walls of a hospital, leave it to practise their professions in the community, imbued with its ideals, but with an inadequate understanding of its true significance. The approach to public health, which the Western world sponsored, and from which it derived such immense advantages, has been forgotten. The world community itself is hardly aware of the advantages and disadvantages of the change.

The essential needs of public health remain the same. Public health is rooted in the environment; in the way people live, in the social factors of the home and the workshop. For these the hospital, however much relief it may give to the sick and suffering, is only a partial answer. But public health must face the world as it finds it, and be prepared to re-examine it constantly in the light of changing values. The modern hospital constitutes a new problem in public health.

Every country can be said to have two particular needs – interlocked and in many ways inseparable, in some ways favourable

and in others antagonistic – one for a healthy community, the other for specialist care in hospital. World health needs a proper balance between them. The amount of hospital provision is a reflection of the success or failure of public health. Every community must spread its resources, so as to achieve the greatest measure of prevention with a proper regard for the calls of human suffering. This is not easy, but it can be accomplished by building up strong public health services and by making the hospital an agent of public health.

THE HOSPITAL WITHIN A STRONG PUBLIC HEALTH SERVICE

The first essential is to shift back the focus of medical care to the community and to lessen the emphasis upon hospitals: to create everywhere sources for community health in terms of the family at home and at work. The dramatic appeal of the hospital both for doctors and laymen alike, which the development of scientific techniques of treatment continually fosters, must be held in check. The Public Health Service in every country must be given first priority to develop measures to keep the community healthy. One of its main objectives is the good home which builds up health and supports in sickness. This can be done in many ways in the widely differing circumstances that the world presents; but little doubt remains that the establishment of *health units*, directed by health officers trained in public health, and equipped with *health centres* for day-to-day work in preventive and curative medicine, has the greatest possibilities for general use[25] (see Chapter 17). In this way medical and social care are firmly united, and the general medical practitioner is enabled to work with midwives, health visitors, sanitarians, and other social agents. This provides the means for a continuous study of disease and ill-health within the community. In those countries where general practitioners of medicine exist in large numbers, or where health assistants are used, general medical care and public health might well operate as one administrative unit.[6]

The real focus of interest of public health – a healthy nation – is thus clearly established. Within such a system the hospital is better able to take its place as an essential arm of a total service. The need for hospitals – as with those for infectious disease and to a lesser extent for children – can be reduced by successful public health. Their construction should never be too lavish. Many have said, with some truth, that any nation can fill unlimited beds in mental

hospitals. But, if the focus of mental care is shifted back to the community, too many beds may be a positive disadvantage; quite apart from the cost, which must cut heavily into other community programmes. Budgets must not be so weighted with hospital expenditure that social and preventive measures are hampered: hospitals must be weighed carefully in the balance with other forms of community care. Hospital work should not be more highly esteemed or better paid than medical care for the community outside; nor should greater emphasis be laid upon training for specialist work in hospitals.

The superiority of hospital care over home care also needs to be critically examined in all societies – on social, psychological, and financial grounds. The damage to young children which Bowlby[2] has reviewed, and the success of home nursing services – for children's illness at Rotherham,[20] for premature babies in the West Riding of Yorkshire,[23] for the chronic sick like that attached to the Montefiore Hospital, New York,[13] and many similar schemes in Europe – need to be looked at in terms of the social background of every country. Old people are known to fare badly when removed too long from the community and confined to institutions.[6a] About the mentally ill, the Royal Commission of 1954–7 in England and Wales said:[10]

> In relation to almost all forms of medical disorder, there is increasing medical emphasis on forms of treatment and training and social services, which can be given without bringing patients into hospital as in-patients, or which make it possible to discharge them from hospital sooner than was usual in the past.

The treatment of the tuberculous in sanatoria was a brilliant innovation by pioneers of social medicine at the end of the nineteenth century. But today, with the means to diagnose and treat tuberculosis within the community, it is doubtful whether many countries now setting out to overcome the White Scourge would be wise to make more than limited use of them; monies can be better spent on dispensaries and home treatment associated with health centres.

Hospitals are an essential need of all communities in all stages of development; but they have to be seen in the perspective of a sound community based upon good homes. The stay in hospital should be a step in rehabilitation to full life outside – neither unduly prolonged nor unwisely considered. It is not a substitute for a good home, such as the excess of single persons – particularly those in chronic sick and mental hospitals – in England and Wales on Census night 1951[1] suggests to be the case.

THE HOSPITAL AS AN AGENT OF PUBLIC HEALTH

Secondly, the hospital must be an agent of public health. As the first report of the expert committee on the rôle of hospitals in community health protection said:[24]

> The hospital is an integral part of a social and medical organization, the function of which is to provide for the population complete health care, both curative and preventive, and whose out-patient services reach out to the family in its home environment; the hospital is also a centre for the training of health workers and for bio-social research.

It may help sometimes to day dream. Few hospitals have this outlook and many are unlikely to develop it. We must indeed realize that the interests of the hospital are sometimes in conflict with those of public health. The hospital is not unique in seeking to seal itself off from the community affairs – most institutions have the same urge. The combination of hospital with health centre, recommended by Bridgman in his *Rural Hospital*,[3] may be one of the means to overcome this difficulty; but this expedient can fail where the interest and appeal of curative medicine come to dominate the scene. The responsibility must be with the public health organization, either working with headquarters in the hospital, or distinct from it, to draw out the hospital gently but firmly into a wider sphere. 'The hospital should organize itself to serve the community in all aspects of health care and can contribute much to improve the community health';[24] 'The general hospital . . . should not limit its functions to the restorative sphere, but should . . . organize itself to serve preventive, educational, and research ends as well.'[24] In short, the hospital should be an integral part of society, and not, as so often and so long, a monastic institution separated from the world around by high walls of brick and prejudice.

What this means in more particular terms must depend upon the social organization of each country. It may be that the hospital will be the centre of preventive work through a system of peripheral health centres; that it will be the leading spirit in a scheme 'to link together all aspects of the healing art and to prevent disease';[24] that much of the vital work of public health in case finding, health teaching, and special examinations will be organized as part of central out-patient departments with satellites throughout the area; that the hospital will be the centre of home care schemes and other extramural activities. This is already becoming the case in many parts of the world. On the other hand, many countries may not wish to

centre too many activities for the promotion of health upon institutions primarily for the care of sick people. For them the health centre will perform many of the functions of out-patient departments, retaining a close link with the family, home, and factory, and obtaining specialist advice from the hospital. Such details are for local decision.

But all hospitals everywhere must be *socially orientated.*[5] The ideal is to use the hospital to the best advantage socially as well as medically. Every patient in hospital should be regarded as a social problem for himself and for the community. Hospitals should also be dynamic, seeking to establish themselves as centres of rehabilitation; as places to which the sick can enter for diagnosis and treatment and from which they will return home. Retention for long periods, as has happened for mental disorders, mental deficiency, and the chronic sick, can often be avoided, where the hospital is working in partnership with the health unit. Since the hospital reflects an important aspect of the picture of disease in the community, it must be both a centre of statistics and a source of information on infections on which it can provide a running commentary; quite apart from the spread of infections within the hospital itself, which occurs despite the successes of medicine and nursing. Of every 1,000 children admitted to hospital, in terms of the survey by Watkins and Lewis-Faning,[22] seventy-one are given a new disease, and four or five killed. Paul[18] has said that 'it is more dangerous to admit a very young child to hospital than to allow him to play on an arterial road'.

Hospitals collect together many who are in need of teaching; and they provide admirably the milieu for health activities. Every advantage should be taken of this in the out-patient departments and in the wards. Every hospital should also have a centre of social work with specially trained staff for interviewing patients and relatives and for obtaining background reports. Such a dynamic approach, in these and other ways, more than any other measure, will help to bring the hospital into closer touch with the community. But for its development it calls for the appointment to the hospital staff of a *social physician.*[5] As the WHO report suggests,[24] every general hospital – or group of general and special hospitals – should have a department of social and preventive medicine directed by the medical officer of health of the local health unit. In this as in other advances in public health the prestige of the hospital is so high today that it can afford to lead the way in breaking down the barriers which may exist between itself and other services.

CHAPTER 12

Food

THE WORLD'S MENU

MAN in his most primitive form will have known that his health and strength depended upon having enough to eat. Throughout his development, in and out of civilizations, food gathering has been one of his chief preoccupations. But the influences at work, for good or ill, have been many and varied. Man's diet has been the expression, as it were, of their inter-action; population growth, agricultural development, the existence of local hazards or advantages, the bending of nature to man's will by artificial or natural selection, scientific advancement, the introduction of new dangers by harmful practices or social customs, these and other considerations have taken part in an endless and dynamic struggle.

With so many variables to determine the menu, the diet of the human being has been subject to kaleidoscopic changes. Throughout history some people have fed well while others have fared badly. The skill in husbandry, for which the Romans and Greeks were famous, gave abundance. The millions who lived around the Mediterranean seaboard lived in dietetic luxury. So too the English countryman of 1740 fed well.[5] The renaissance of agricultural learning had reached Britain from the Continent; the potato, after a century of neglect, was being grown in large quantities; garden vegetables had spread beyond the estates of the wealthy; livestock abounded; and the grain was whole and nourishing. The result was a full diet of dairy produce, potatoes, vegetables, and oatmeal or wheaten bread.

But these periods of good feeding, as so many others at different times and places throughout the world's history, have been followed by scarcity. Inefficient strip farming, with its low production and poor cattle rearing, followed the break-up of the Roman Empire. The new townsmen and women of industrial England exchanged the diet of the countryman for a roller-processed wheat adulterated with alum, a disgraceful episode to which Tobias Smollett (1721–71) refers when he makes his character, Matthew Bramble, say:

The bread I eat in London is a deleterious paste mixed up with chalk, alum and bone ashes, insipid to taste, and destructive to constitution.

Many similar contrasts can be found in the world today, for example, the wholesome diet of whole wheat, milk, meat, and cheese of the hill tribes of India is strikingly different from the diet of polished rice of the lowland peasant.[11 12] Moreover, food has always been a good social ingredient, unequally distributed in quantity and quality; good living has been for the rich, bare subsistence for the labouring poor; the manchet loaf for the Lord of the Manor and cibarus, the bran loaf for 'all servants, slaves and the inferior type of people to feed on'.[8] Therefore the social class gradient is one of the main considerations of public health.[4] Poverty results from the interaction of income with basic essentials, of which food is the most important. The poverty line which Rowntree described in 1899,[14] mainly based on food, has always existed. But the distinction between primary poverty, where there is too little money to buy food, and secondary poverty, where the household budget has been improperly spent, is steadily getting less. The household budget should permit of other expenditure than that upon 'minimum necessaries', if we believe that the full life and the fair diet should be inseparables.

Family life exerts its own biological forces which cannot be easily countered. Expenditure upon food per head within a static budget gets less as the number of children increases. The tighter the budget, the worse the quality; the fewer the calories, the more carbohydrate, less protein and protective elements. In Britain in 1952, 2,500 calories cost 7½d in the form of bread, 3/1½d as milk, 8/- as vegetables and 16/6 as eggs.[1] Thus, as the family grows in size the diet deteriorates and its balance is upset.[1]

Nations are like families in this respect. All over the world where there is little money and few calories, the food consists mainly of cereals, alone or with sugar, the cheapest satisfiers of hunger; thus, in India cereals and sugar provide 1,500 calories out of a total of 2,000. New Zealand and Denmark, with high average food consumption (about 3,300), have a low cereal intake of approximately 900 calories with high milk and meat consumption. Java, with a daily average per head of less than 2,000 calories, has a wholly unbalanced diet with animal protein as low as 4 grams.[1] To feed the people according to their biological needs calls out the best in every nation – in education, statecraft, and social organization. But of all influences at work upon the diet, man's multiplication has been the most potent. Food, until recently, has provided an

automatic check upon the numbers living in any region; causes of decline have been, as in the animal kingdom, 'density-dependent', since overcrowding promotes contagion, and the under-nourished are an easy prey to infection and hardship[7] (see also Chapter 3). To this simple law of mass action, another force has been added – understanding. The Malthusian spectre dogs man like a shadow, but we can keep one step ahead with the aid of science. Skill in husbandry, and public health, are the way forward to a new balance with food.

Man himself has often made things worse. The plague of rickets came to Northern Europe, already deprived of sunshine, with the smoke clouds of the coal-burning domestic chimneys and foundries; and to Asia Minor, where the sun pours from cloudless skies, with the over-clothing of infants, which religious custom demanded. The use of chemicals to whiten bread – alum in the last century, agene yesterday, sulphur dioxide today – and the polishing of rice, to satisfy social demands, have all robbed man's staple diet of much of the Vitamin B complex, and of other essential nutrients. The introduction of small power-driven mills is rapidly increasing the consumption of highly milled rice in areas where previously rice could only be hand-milled.[2] The hydrogenation of unsaturated fats to produce butter substitutes and the excessive use of refined 'sugars' are also probably adding to the man-made hazards.

The soil upon which man depends for his very existence has been lost to him by carelessness and ignorance. In his haste to cultivate it he has often heedlessly removed the trees, bushes, and grasses which sustain it. Dried by the winds, it has blown away in dust clouds; soaked by the rain, it has been carried to the valley bottoms. The barren sub-soil, denuded of its lush covering, has been added to the deserts. Soil erosion is one of man's greatest enemies, for the earth's surface is limited. The 3,500 million acres now in use might be doubled by the inclusion of deserts and marginal lands. Every acre added to the present land in cultivation is important, but the overriding need is for scientific farming everywhere. Great areas of the world yield only 6 to 7 cwt of wheat per acre in comparison with 20 cwt or even 50 cwt in Europe and the New World. It has been said that India could use twenty times as much fertilizer and increase its yields in ten years by 30 per cent. Milk and meat may be similarly increased by breeding and the elimination of cattle disease.

HARNESSING THE SOIL

Since man began a settled life, his diet has depended on his ability to harness the soil. Some regions of the world will have been naturally more productive than others; but, this apart, food production has called forth many skills – irrigation, terracing, drainage, fertilization, instrument making. The cultivation of grain in areas cleared by fire began agricultural experiments. Chemical fertilizers, first produced in abundance in the middle of the nineteenth century, are but the latest method of soil enrichment, which dates back to early times – guano in Peru, powdered pumice in the Gilbert Islands, human excreta in China, Mexico, and elsewhere. Much has depended on mechanical aids, advancing with a spurt here, lagging a few centuries there, but always tending to improve the yield per acre and the acres tilled. Expansion and development, as in the breaking and cultivating of the black land of the Middle West of America, have been the greatest challenge.

Every generation has contributed agricultural implements. The scythe replaced the sickle; the modern plough is the direct descendant of the digging stick, still in use in primitive societies. Threshing with the hand-flail, or by driving animals on a treading floor, and winnowing by hand, were ingenious innovations for earlier civilizations – destined to spread throughout the world. Thus, the nineteenth century, which ushered in the age of mechanical farming, was building on a long past. Newbold's cast-iron plough (1797), Bailey's mower with the circular blade (*c.* 1820), and the early threshers (1825), were adaptations of old ideas. Forty years of trial and error were needed before the binding of sheaves could be done by machinery – the Appleby Knotter (1878) probably influenced man's diet more than any improvement since the introduction of the horse. The modern grain separator which sails over Canada, the Middle West of America, and the Ukraine, threshing, cleaning, weighing, and bagging, is a combined effort of all men – at least from the Stone Age to the present day – in search of a decent diet.

Foods of particular value to man – the results of natural selection which have made their appearance in different parts of the world – have been carried by traders and adventurers to distant parts. Oranges and lemons, which cling to the warmth, have been cultivated for export to less favoured regions – northern territories, whose native fruits, apples, pears, plums, and even the cherry which the Roman legions transported, are deficient in Vitamin C. Rice

has been unwilling to leave the tropical zone, but other cereals – wheat, oats, rye, millet, dura – have slowly spread to cover a large part of the earth's surface. The potato and tomato, which appeared in South America, have each been transported to far distant places at different times in history. The wheat grain, Red Fife, specially suited to the southern prairies of Canada, and later its offspring Marquis, Yeoman, and Holdfast, which thrive also in the shorter summers of farther north, have helped to increase the area in Canada under wheat cultivation from 2·7 million acres in 1891 to 27 million acres within half a century.[15] Extensive cultivation of *Solanum tuberosum,* the humble potato which the Spanish discoverers of America brought back to Europe, dispelled the dreadful scourge of scurvy and may well have been a stimulus to set on foot the industrial and agricultural revolutions. But the struggle has been one in which nature has often lent an unwilling hand, or none at all. In countries where maize has been the staple diet, there has been pellagra from lack of nicotinic acid; in others the alkaloids of the senecca plant act as liver poison. Everywhere seasonal shortages, floods, and pests have brought malnutrition and even famine. The land food gathering has always been a struggle against the hostility of physical and ecological powers – to be fought by ingenuity and knowledge. And since the health of the whole human family now is involved, it has become a problem for world health.

More recently, artificial selection has been added. No doubt it has been in operation, for both plants and animals, with periods of rapid advance and others of stagnation, as long as civilization. Robert Bakewell (1725–95) in the early eighteenth century inaugurated a century of intensive selection which produced breeds of cattle, pigs, and sheep yielding twice or three times. These have populated the New World. But he built on what had gone before. Roman livestock may well have been fattened and kept through the winter – an art which was lost to Europe for a thousand years. The art of growing the turnip and clovers and the common garden vegetables, so necessary to beast and man, was re-discovered in Europe in the early eighteenth century. Plant genetics is now helping to breed stronger wheats resistant to disease, and with better quality protein; and is giving us drought-resisting grasses which can make grazing lands out of marginal wastes.[8]

Our ignorance of causes has been largely dispelled. The spirit of James Lind, who on 20 May 1747 took '12 patients in the scurvy on board the *Salisbury* at sea'[10] has lived on. Takaki, Eijkman, Barlow, and others, have added clinical observations about the

relationship of food to health. The chemistry and biochemistry of food have been laid bare. In 1906, rats subjected to a purified diet told us perhaps the greatest truth of all, that 'In diseases such as rickets and scurvy we have had for long years knowledge of a dietetic factor, but the real errors in the diet are to this day obscure. They are certainly of a kind which comprises *minimal qualitative factors*' (Gowland Hopkins).[7a] Since that time, the accessory food factors have one by one been hunted down – the 'real errors' have become known. To the importance of food as a source of calories and nitrogen, we now add several dozen substances needed in minute amounts. But always there are new horizons – scurvy, beri-beri, rickets, keratomalacia, and pellagra are milestones. Today's problems are equally momentous – millions with kwashiorkor in tropical countries,[9] atheroma in the ageing peoples of the Old and New Worlds (see Chapter 3).

FOOD AND WORLD HEALTH

No uniform plan can ever be devised to meet the needs of all countries; but all should make the feeding of the people with a balanced diet their ideal. The needs of growth – protein, calcium, Vitamins A and D, and the B group – give rise to much the same problems everywhere. Calcium and Vitamin D are universally limited in their distribution in nature and the Vitamin B group is always needed in greater amounts as the carbohydrate increases in the diet. Protein is everywhere so expensive, when the national or family budget is near the poverty line, that it is difficult to obtain in sufficient amounts.

Public health cannot work in the dark; it depends on accurate knowledge of what is required for a realistic food policy, i.e., upon a knowledge of the existing state of the diet.[1a] This entails the use of the dietary survey, to discover what people eat and how diet is related to custom, prejudice, ignorance, money, or cooking. Of the four types of dietary survey – statistical studies of national resources, and the study of groups, families, or individuals – each can be used in different circumstances by questionnaire, log book, or weighing techniques. Surveys such as those by Edward Smith (see p. 286) and John Boyd Orr[13] have played a vital rôle in the building up of an understanding of nutritional needs in individual countries.*

The results of successive sample surveys of food consumption

* Surveys are discussed in detail in Chapters 25, 26 and 27.

and expenditure (see p. 278) have made it possible to study family needs at various income levels and the effects of social policies upon them. Thus the diet in Britain in 1953 was much different from that in 1936–7; there had been a levelling out in the lower social classes of expenditure, particularly of eggs, butter, fresh meat, and vegetables – a clear result of national food policies.[4] Every country can study with advantage its own social pattern – how people feed and what they need.

When the national larder is examined for protective foods – milk, unpolished rice, and whole wheat, fruit, and vegetables – many nations find a disturbing imbalance. Sugar, whose shortcomings are plain, occupies too large a place. The pressures to mutilate the staple grain of the country are always strong, although the loss of the Vitamin B group together with the essential amino acid lysine and much valuable iron, and even possibly of essential fatty acids, is harmful. Milk, the main source of calcium, and containing valuable protein and other nutrients, is hardly obtainable throughout most of the under-developed countries. A low milk production in any country usually means that the children are undernourished, and that the process of gestation is endangered. In 1956 UNICEF provided skim milk to some 50 countries involving 2,700,000 children.[16]

Since then important developments have taken place in the preparation of milk substitutes which, if properly exploited, will go far to remedy the grave evils of protein starvation particularly among the young. C.S.M. (cornflour 70 per cent, defatted soya flour 25 per cent and skim milk powder 5 per cent) is now widely used by UNICEF and distributed under bilateral aid. *Incaparina,* a powder of the Institute of Nutrition of Central America and Panama, consists of finely ground corn (29 per cent), soya bean (29 per cent), cotton seed (38 per cent), Torula yeast (3 per cent) and chalk (1 per cent); it is given easily as an 'atole' or hot drink, or incorporated in soups and puddings. A great variety of milk substitutes are now being developed in different parts of the world; like *Incaparina* in Latin America, these should have the additional advantage of making the developing world more independent of outside aid.[17 18]

The manufacture of protein by unicellular organisms (yeast, microbes, amoebae) is now advanced; this makes use of a mixture of petroleum or paraffin (for energy) and nitrogen compounds (urea, ammonia) with added minerals. So is the production of Lysine, an essential aminoacid which can raise the nutritive value of cereals, rice and cornflour from 50 per cent to 75 per cent, also far advanced.

The artificial production of protein and lysine together may well revolutionize the world protein situation, dependent of course on three still unexplored factors – cost, toxicity and acceptability.

Feeding according to biological needs has more to offer to the world than almost any other form of public health. Special feeding for vulnerable groups is likely to be needed everywhere – milk distributed through schools, child health centres, or hospitals; vitamin preparations for pregnant women; meals, and high protein concentrates, for children. School meals are of particular value, since they ensure that children get the full benefit of national expenditure. The subsidizing of essential foodstuffs, priority distribution, and fortification of foods with essential nutrients, such as margarine with Vitamin D, rice with nicotinic acid, or salt with iodine, are valuable steps. Farming developments can, with advantage, be closely related to nutritional status and to the findings of dietary surveys.

Yet an even more fundamental solution is needed – teaching the family to make the best use of local foods, which local experiments have shown to be fruitful.[16] All measures designed to feed people properly will succeed only if closely integrated with public health teaching – fully alive and sympathetic to the customs and beliefs which determine the pattern of life in the household (see Chapter 6). Nutritional advance, like so much else in public health, is not solely a question of techniques.[3] How strong are the forces with which public health has to contend was seen in the persistence in Coonoor, South India, of age-old customs of feeding infants, long after the establishment of health centres.[2] In the past workers tried, by repeated blows of didactic teaching, to hammer through the haze of tradition, taboo, and magic; more recently, we came to realize that beliefs about food are part of the whole fabric of the people and cannot be changed in isolation.[2] The most effective channel of nutritional teaching, if given by well-trained doctors and nurses, is the maternal and child health centre.

The great advances in knowledge have not so far solved man's difficulties, for the problem of human nutrition is economic and social as well as biochemical. The saddest of all happenings to an ill-fed world is the destruction of surplus crops when swollen markets have caused a slump. Economy has often turned a blind eye to the world's suffering. And for many countries, higher nutritional standards cannot be achieved without an improvement in trade. When people live at a low subsistence level, hunger is a driving force to be satisfied irrespective of protective foods – kwashiorkor with, rarely but tragically, cancrum oris, keratomalacia, and many other nutri-

tional disasters, must follow (see Chapter 3). Economic development often provides the only means to break the vicious circle of poverty, hunger, malnutrition, ill-health, and physical inefficiency. Europe needs to import food, and has the money to do so; but so on balance must the Far East, and it has not. The Western Hemisphere and Oceania need to continue their exports of food if the world diet is not to decline still further; but already surpluses decline and exporters (e.g. Russia and China) have become importers of food.

Every nation must put its own house in order.

The spectacular rise in food production in North America over the past few decades was not the result of good luck. On the contrary, in a world with a growing population and a growing multiplicity and complexity of wants, the advantage lies with nations possessing a large territory under unified economic control, where land and other resources are ample in relation to population, and where modern techniques can be developed and applied without hindrance. In many of the less developed regions, land and other potential resources are available in abundance, but unified control has been largely absent and modern techniques have not penetrated the masses. In other parts of the world, as in Europe, some national units have become too small for full advantage to be taken of modern forms of industrial organization and technique. Persisting trade and other barriers have resulted in diminishing returns to a point at which economic standards can scarcely be maintained. Second World Food Survey, Rome, 1952.

If present technical knowledge can be spread, potential food production is extremely large. The use of organic and inorganic fertilizers, control of pests and disease, better seed and appropriate methods of cultivation, together with the large possibilities of extending irrigation and double-cropping, provide the means of increasing crop and fodder yields. Better and scientific feeding, timely use of forage crops, control of animal disease, and an efficient breeding program can likewise increase yields of livestock. Without any expansion of the cultivated area the production of crops could well be doubled. For livestock products the prospects are even better, although yields as high as those in some developed countries are not likely to be obtained until the scarcity of feeding stuffs has been overcome. Third World Food Survey, Rome, 1963.

These are encouraging words, but still we face the rapid expansion in population (see Chapter 8). In the decade since the first edition of this book, the total world population has increased from 2,600 to 3,250 millions. Total food supplies in 1975 will need to be increased (on 1963 data) by 35 per cent in cereals, 85 per cent in pulses, 60 per cent in animal products, i.e., an overall increase of 57 per cent; in the year 2000, the increase needed will be 174 per cent. Despite all that can be said about the possibilities of increasing food production all is jeopardized by our inability 'to make rational use of nature's bounty' (F.A.O. 1963).[6] International acceptance and vigorous pursuit of family limitation by all or most countries of the world

will be needed to prevent further disastrous decline in nutritional standards.

The nutritional problems of the world also call for concerted *international* action to expand the crop area, to raise yields, to improve livestock, and to reduce waste. Few nations can now hope to solve their problems alone and unaided. The pooling of resources, technical knowledge, and experience through WHO and F.A.O. has already given rise to great improvements. But international collaboration is needed on a wider scale if the great obstacles to capital development are to be overcome and the orderly marketing of foodstuffs at reasonable prices is to be ensured. The World Food Board is still much needed to stabilize prices, to establish a world food reserve, to provide funds for the disposal of surplus, and to organize international credits. Countries, like human beings, must help each other. 'The World Food Programme launched jointly by the UN and F.A.O. on an experimental basis is a welcome indication of our awareness of this task'.[6]

CHAPTER 13

Industrialization

In terms of public health, and possibly of other evaluations, industrialization implies radical alterations in society, with far-reaching effects for every member of it. Industrialization is new, in this sense, but industry is not. If industry is large-scale manufacture, it was in operation in the mines of Rome and Greece and in the mills of Antioch and Tyre. Pottery has likewise been manufactured on a large scale for ages. The five towns of Staffordshire (England) – Burslem, Tunstall, Hanley, Stoke, and Longton – were loading immense quantities of pottery on to pack-horses, for transport along muddy lanes to far-off parts, for two centuries before industrialization began.

The manufacture of cotton goods flourished throughout the East from earliest times. For centuries this was the chief source of India's wealth, owing its reputation to the exquisite skill and delicate touch of the Hindu. India clothed much of Southern Asia. The cotton industry was introduced to Spain by the Moors in the tenth century, by the twelfth century exports of cotton from Genoa were brisk, in

the fifteenth century fabrics were being produced in Flanders and, after the arrival of religious refugees from Antwerp in the late sixteenth century (1585), in England. For two centuries the cotton industry flourished in England without the phenomenon of industrialization having developed. Kay's flying shuttle (1733) and Hargreaves' spinning jenny (1770) made no essential change. It was not until Arkwright's roller spinning process was patented (1769, 1775) that industrialization in the cotton industry began.[2]

Industrialization cannot easily be described in terms of one factor. It displays a number of different characteristics, dependent to some extent upon where and when it has taken place. The most ubiquitous of these is *transformation of a peasant society* into a community dependent upon the factory. A peasant society works in crafts and local manufactures, mainly in its own homes and generally in its own time. It exists on locally-made goods and locally-grown food. For the sale of its wares, peasant and townsman deal directly in local markets and pedlars and travelling dealers take the place of shopkeepers.

A peasant society is knit firmly together by long-established practice and belief. Thus authority tends to be concentrated in one member of the family; in Europe it was generally patriarchal. In most parts the ties with the land – the essential feature – are strong. The hard life with few luxuries is the lot of nearly all, especially in countries, as in Europe, where the climate can be severe. Man and beast may share the same dwellings. So too the forces of nature – food, famine, and pestilence – impose their will upon everyone, while foremost there are customs from which it is not easy to depart and which restrict activities and curtail initiative.[5 6] (See also p. 52.)

The peasant has a sense of security which flows from his attachment to land and family and from the customs which contain his daily life within a narrow compass. Yet paradoxically on his translation to an industrial society he becomes bound in other ways, for he loses the right to use his own initiative and to exercise choice in the way he does his daily tasks. Impersonal discipline now replaces the authority of a relative or friend. Time often has a new value, imposing fresh strains upon those who have lived in societies where people work as necessity calls and who can enjoy to stand or sit for long periods in contemplation. It has been said that from a craftsman in his own right he becomes a cog in a machine. Nevertheless he must often have escaped from the restrictions of authority within his own family by acquiring an independent source of income; and the industrial society into which he enters, if without ties of kinship,

may restrict his movements less. He may also eventually, as his horizons widen, be less a prey to superstitious beliefs and be freed from anxiety about the forces of nature.

The factory where men and women are collected together for work is an almost universal concomitant of industrialization. While cotton goods were made in the home – even after the introduction of the flying shuttle and the spinning jenny – the age-old tradition of a family occupation, with family and village responsibilities, continued. But the roller spinning frame, worked by water power, took cotton into the factory, and began industrialization. Although physically they may vary from mines, or brick ovens, to an establishment with large shops for assembling motor cars, yet all factories are alike in introducing new features into the community life. The mass of persons taking part have no property in the land, the capital, or the instruments; they work away from home; they are paid by wage; and they must tend machinery. The factory, although not universally, relies upon machinery driven by mechanized power. It is true that Staffordshire pottery-making became industrialized with the throwers' wheel as the main machine – identical in mechanical principle with that used by the ancient Egyptians – and without, at least immediately, any mechanical propulsion; but this is an isolated instance.[2]

The factory involves society in *migration*. Often whole communities have left a settled country life to live, at a distance, in towns. Or the men may travel away from home to work, spending perhaps the whole day, or, as in Africa and elsewhere, being absent for weeks and months. But men have left home in fishing communities, for days or months, for many ages past. Men have left the Balkans, and other countries, to earn money for their families – possibly even fortunes – in distant lands, where standards are higher and opportunities greater. From far and wide they come to pedal a samlaw in Bangkok, Jakarta, or Rangoon, and, if they survive, return to their villages after months or years to live in relative opulence. Yet migration of peasants to towns is one of the hallmarks of industrialization; and even where it is transitory it either represents a transition phase, or it may mean industrialization elsewhere.

The factory also tends to take the women from the family. They leave the spinning and weaving in the home, the keeping of livestock, the laundering on the slab by the village fountain, or on the rocks by the stream, for something like the life of a man ordered by the same rules, and subject to the same hazards.

The factory introduces the money economy, if this is not already

present; and the use of money can help to break down traditional practices and family relationships, especially in those societies where wealth has lain in herds of cattle under the head of the family, or extended family, to whose authority all have bowed.

Yet the factory is not a new invention. Men and women have long been collected together in mills and mines. The distinguishing feature of the factory in an industrialized nation is chiefly the extent of its development, so that the community becomes dominated by it, and life centres around it. The establishment of only a few factories in a peasant society may mean the beginning of the irreversible process of industrialization.

'Industrialization' implies that *occupations become more sharply defined*. In the old pottery industry, master potters each had a single oven with six men and four boys. They undertook the whole range of operations. Journeymen potters were accustomed to pass from one kind of labour to another, just as impulse or convenience demanded.[2] When industrialization began – as oven was added to oven and the brick factory replaced the master potters' family concern – the work was divided into many distinct categories – throwers, turners, oven men, flat pressers, hollow ware pressers, dippers, etc. Subsidiary and complementary trades – crate makers, colour makers, lathe makers – grew up around it. Moreover, *occupations tend to change* as processes alter with new inventions. Thus, the use of coal instead of charcoal in the production of pig iron changed the character of work for many thousands in newly industrialized iron districts. The master hammersmith disappeared almost overnight, and in his place, puddlers, rollers, and other new classes appeared. Not only 'change', but the possibility of it, and to some extent its inevitability, provide one of the most significant contrasts of an industrialized society with the age-old life of the village, hallowed by long tradition. Any change in technological processes in turn affects the whole life of the community.

Industrialization is also distinguished by its emphasis upon *production for the masses* – designed to meet the needs of mankind as a whole, and not, as was generally the case in earlier centuries, dependent upon the making of luxury goods for the few. This has been described, not very accurately, as satisfying the needs of the poor, so that in 1831 it could be said that two centuries before, not one in a thousand wore stockings, whereas by then not one in a thousand was without. Industrialization thrives upon the width of market which only the inclusion of everyone – rich and poor – can produce. And in its turn it revolutionizes the life of the members of

society by making goods which affect almost everything in life from diet and travel to hospitals and television. It is based upon commerce with other nations, and it encourages its further growth.

Finally, industrialization determines a *different economy*, which in turn reflects upon the structure of society. It can only take place when large resources of capital exist, and it promotes a process of further accumulation. This again is not new – Roman and Venetian industries depended upon capital – except in the extent to which it became the driving force in society. The industrial revolution gave to capital a much wider control over the life of men. Capital – whether from the State or private sources – provides the motive force which drives the whole industrial machine.

THE INFLUENCE OF INDUSTRIALIZATION ON PUBLIC HEALTH

Industrialization came first to the world chiefly in England during the later years of the eighteenth century. It created an upheaval – social, environmental, and cultural – and gave rise to changes which had not been previously encountered. This first episode coincided with the great inventions and discoveries which began to make man more quickly the master rather than the slave of his environment. But it found the world unprepared to meet the evils to which it could give rise, although able to benefit from its advantages. The factory system was called the English System, but it travelled fast to some other countries, particularly Belgium, and more slowly to others such as Germany. In all these it reproduced much the same phenomena. Fielden referred to American factories in 1833 in his *Curse of the Factory System.*[2]

This is not the place to examine in detail the reasons why this phenomenon – which affected the world's health and welfare so extensively – should have begun mainly in England. The usual catalogue of circumstances can be paraded, but they are of little interest – except so far as they help us to understand how much industrialization depends for its effects upon the social background of the country in which it occurs. Before the remarkable series of inventions upon which it was based began, England had a government favourable to commerce; it had internal free trade and a prosperous and growing textile industry; it was already an exporting nation with large commercial connexions; it had a banking system and had evolved joint-stock companies; its common law gave a measure of individual freedom; its aristocracy had the tradition of

engaging in trade; nature had given it coal – abundant and near to the ports – and a climate suitable for spinning cotton; world events had placed it on a great water route between Europe and America; and the Elizabethan adventurers, seeking outlets for commerce, had taken its ships and trading companies to Eastern markets.

Everything was favourable to industrialization. There was no special barrier, as in Rome or Greece, to prevent the use of inventions on a large scale – no high-minded Roman to tear up as dangerous a proposal to mechanize a traditional process, and no Greek Hero to see in the steam engine the means only to pump libations for the temples. It was as natural for the disciples of Newton to think of industry as it was for those of Archimedes to turn against it, for inventors were free to experiment, with the near certainty that the results of their genius would be put to productive purposes. Thus it was essentially the political, economic, and social background of England which determined the course of events. So it is today.

Industrialization in the eighteenth and nineteenth centuries led immediately to ugliness, squalor, and insanitary dwellings, to exploitation of the wage earners, to high mortality and spreading infections, to a loosening of family ties and morals, and to employment of children in conditions that the twentieth century hardly likes to recall. These circumstances arose because the state of society favoured them. Exploitation of the worker was part of the same set of values which allowed the traffic in slaves in which the new industrialized societies were engaged. The wealth of industry then played little part in achieving harmony with the physical environment because money became an end in itself; so that towns of the first industrial period, without plan or beauty, were symbols of the age, just as were the cathedrals of medieval Europe, or the amphitheatres of Rome.

Everywhere throughout the world it is the structure of society and its culture with which we must be concerned in garnering the fruits of industrialization and in mitigating its evils. In the country which gave it birth this was soon to be seen in the variations which occurred in different areas. In Manchester, where there was already a strong social framework, and powerful voices for reform and the remedy of abuses, the impact was modified and mollified – whereas in South Wales, with thousands of immigrants and without the restraints of tradition, experience of government, or common history, conditions resembled those in a gold rush. So the effects in Japan will differ from those in America or Africa.[9]

The developed nations, now that they have for the most part overcome infections, find themselves beset with a multitude of social problems. Some appear to be due to a loosening of family ties, others to a sense of uncertainty from loss of faith in divine purpose, still others to increasing difficulties of human relationships. Much illness, as seen by the general practitioner or in the out-patient departments of hospitals, appears to be psychosomatic, or as part of an escape mechanism, or of a stress phenomenon. Mental illness is more obvious, if not necessarily more frequent, and the extent of departures from mental health is thought by many to be widening. Both adults and children have behaviour difficulties (see p. 17).

In different ways the under-developed countries seem to be involved in the same process. Separation from wife and home, for example, is the cause of spreading venereal disease in many African communities. Promiscuity, alcoholism, and syphilis accompany the break-up of the African family.[3] Cash crops and a wage economy, which upset subsistence farming and introduce processed foods, can be blamed for nutritional disease. Destitution and poverty may be the lot of the displaced industrial worker who no longer has his place in the family and his attachment to the land.

That these social ills arise directly or indirectly from industrialization can hardly be doubted.[8,12] Many are clearly connected – particularly those associated with a break-up of the family (see Chapter 7) and those that result from changed social conditions. In an industrial society, for example, the mentally handicapped, the aged, and epileptics become problems in social medicine, when in a simpler society they may not.[11] The increased complications of life, and the diminished resources of the family, weight the balance against them; as the old become problems, irrespective of infirmity, when the traditional jobs of the countryside and the fireside chair in the family house are no longer available. Epileptics and the mentally subnormal can be accommodated in industry only when careful social systems are devised to meet their needs.

Mental illness is more obvious in the developed world, but this does not necessarily mean that it could not be found equally, if not more, in less developed countries. Yet, if anxiety results from conflict, and this in turn arises out of the need to exercise choice, or from difficulties in personal relationships, here may be found some part of the cause of the psychoneuroses and the psychosomatic diseases, such as the peptic ulcers, which recently have appeared to excess in industrialized societies.[4]

The manner in which this course of events is set in operation is

far from clear. There is hardly likely to be less conflict in the personal relationships within the factory than in a peasant family, living, as already described, on the land. Among the many cultures of the world there are probably few where conflicts within the family circle do not occur. The dominant personality in the extended family, whether father or mother-in-law, or, in different circumstances, both, may be as much a cause of anxiety as the unsympathetic foreman. Daughters-in-law everywhere may display hysterical phenomena, although they will not always complain of them. The indictment of industry for causing greater frustration in highly repetitive and specialized jobs, and for denying the individual the satisfaction of creative work, may also be exaggerated. Life outside the factory may well compensate for monotony within; moreover, thoughts can wander, and social concourse provides its own interest. Industry, however, in giving rise to perplexing choices and loss of security – to which the peasant in performing traditional roles is not subjected – may well be a factor in the production of our social misfits and of the psychosomatic disorders which prevail. But it is not the only, or even the major, cause. The syndrome of conflict is more likely to be related to many things than to any one particular aspect of industrialization.

To some extent the industrialized world has made a rod for its own back. When it calls for punctuality, reliability, and regularity in its workers, absenteeism, hardly recognizable in a peasant society, becomes a social illness. Yet in many parts of the world workers tend to cease work for no other reason than that they do not have a sufficiently strong incentive to earn money, or the urge to buy manufactured goods. Peasants, as in Turkey and elsewhere, generally prefer agricultural work to the factory, so that a transfer to industrial life sometimes takes place only under the compulsion of economic necessity. In the more industrialized societies the sickness certificate may cover up the same phenomenon. We should ask ourselves whether perhaps absenteeism, in seeking to avoid the shackles of the factory and in preferring the simple life, is not a sign of a healthy outlook rather than of social disorder. They have '. . . cut the invisible wires of steel that pull them back and forth, to work . . . hooked fishes of the factory world' (D. H. Lawrence).

Industrialization is not reversible.[10] It must eventually cover the world. For millions living at or near starvation level it appears to be the only answer to a multitude of health problems. It seems unlikely that industrialization – any more than education or public health – can be artificially limited to modify its impact upon societies

of different types.[9] But if the process itself has to be given a free rein, there is much that can be done to forestall the disorders. Where the integrity of families is involved they may be transplanted to the neighbourhood of the factory, or alternatively, where appropriate, industry itself may seek the peasant in, or near to, his own village. Workers can be fitted in to the right job. The working mother and her young children can be given special consideration. Industry can be given a new structure so that workers feel themselves to be part of it;[4] and it can associate itself actively with the life of the worker and of the society of which it forms part. Health departments can widen their outlook and seek to promote the health of society, as well as of its individual members.[1] The family can be made the basis of our health service, using health centres based upon a family practice such as can be seen at Pholela in South Africa and elsewhere.

Towns can be built as true centres of the 'good life'. Security can be given to the worker and his family, no less than that which he enjoyed in his peasant culture. The formula must vary in every society, and in many different circumstances. But, as it is hoped previous chapters have shown, the effects of industrialization on the many different aspects of the life of any community – town living, food production, culture, population, occupation, family life, medical care – can be guided to the benefit of both individuals and society. It is for the twentieth century to show that none of the unhappy sequels of industrialization is inevitable, and that, with due consideration, its advantages can outweigh its disadvantages.

PART FOUR

PUBLIC HEALTH PRACTICE THROUGHOUT THE WORLD

CHAPTER 14

The European Movement

EARLY ATTEMPTS

PUBLIC HEALTH – the application of scientific and medical knowledge to the protection and improvement of the health of the group – calls for organization, a conscious effort by authority. Some form of organization for public health has existed in most societies from the earliest times, but always, until recently, limited by the lack of technical knowledge and often hampered by an inadequate appreciation of the value of health, or by a lack of social understanding. The State doctors of Egypt and Rome, the leprosaria of the Middle Ages, the quarantine procedure of Venice, the sanitary inspectors of Cordoba and other Arabian cities, the regulation of brothels in many societies from the Golden Age of Greece onwards, the Central Council of Health in England which Richard Mead advocated in his treatise on the plague (1720),[32] the local boards of health in Baltimore (1793)[44] and Manchester (1795),[10] and councils of health in Paris and other European cities, are illustrations – but limited in scope.

In the form we think of it today Public Health is new. The highest measure of health for all – not only the privileged few – has never until recently been a national objective. Smillie, writing about North America before 1790, says that during the entire colonial period 'We find little evidence that the authorities realized that they have a direct and continuing responsibility for the health of the people. Certainly there was an almost complete lack of community organization for health services.'[44]

And so might it have been written for the rest of the world at any stage and in any land from the dawn of history. Some or all of the many ingredients which go to the making of public health have always been lacking. When, in the days of the ancients, health was

highly valued for itself, and when the social organization existed through which protective measures could be applied, the social conscience was weak. Significantly, Galen persuaded himself, when physician to the School of Gladiators in Pergamos (A.D. 157), that there was, as he said, 'a certain art of hygiene', but he wrote his book on 'Hygiene' entirely for a privileged aristocracy.[22] When later – at least in the Western world – every man began to be accounted as of value, the health of the body was no longer so highly prized, and disease was often a grace to purify the soul. The cult of individual hygiene flourished through many centuries without giving rise to services for the protection of the community health. The advice on mothercraft which Galen made the basis of his first volume on hygiene might have led to the foundation of a maternity and child welfare service throughout the Roman Empire, as logically as that which followed the teaching of Florence Nightingale and the practice of Pierre Budin and William Ballantyne, in the twentieth century.[10 5] The healthgiving thermae of Roman cities, where baths and gymnasia went hand-in-hand with social activities, might have produced the health centre – if Roman minds had had the social outlook of Andrija Stampar of Yugoslavia. Why did our preoccupation with diet – long recognized as one of the main hygiene agents – have no application as a public health measure? Why did seafaring men need to await the graduation of James Lind and his appointment in 1749 to H.M.S. *Salisbury*, before they were given a service to maintain their health?

> Behind us lie
> The Thousand and the Thousand and the Thousand Years
> Vexed and terrible and still we use
> The cures which never cure. (*Fry*)

'For the life of many men', said Galen, 'is involved in the business of their occupation, and it is inevitable that they should be harmed by what they do and that it should be impossible to change it.'[22] Galen might have argued the case for rather than against an occupational health service, as logically as did Patissier in 1822 (see Chapter 9). So much has depended upon the development of ideas – about the sanctity of human life, about the rights and privileges of all men, and about community organization and the propriety of action by government in matters which concern the individual. Even more has depended upon additions to human knowledge which have encouraged us to think that something effective can be done.

Public health has, even then, often had to await the enlightened self-interest of those who are capable of getting things done; so that

it has been practised when it seemed to lead not only to 'pastures new', but to pastures pleasant. Thus the rich in England played a more active part in sanitary reform once they were convinced that the diseases of squalor might endanger their own lives, as well as those of the poor. Likewise factory legislation followed an appreciation by the employer of the economic value of improved health in the worker.

PUBLIC HEALTH BEGINS IN EUROPE

The eighteenth century had almost passed before public health in the modern sense had begun to develop. It had many points of departure, reflecting the varying ideologies of the peoples among whom the pioneer thinkers lived; and what we see today throughout the world still shows much of the early patterns. It was natural for Johann Peter Frank (1745–1821) to write about social medicine as a police measure, for this viewpoint was an expression of the autocracy under which he and his forefathers for many centuries had lived. Frank's *System einer vollständigen medizinischen Polizey* grew naturally from *Cameralism* – as enlightened rulers conceived the idea of people as the natural wealth of their country.[41] Frank's exposition of social medicine was far ahead of his time – any general concern, for example, for hygiene in the schoolroom awaited the passage of well over a century. But we find little in his teaching to satisfy present-day concern for 'participation by the people', for 'an appeal to the individual', for 'local government', or for 'doing things with people in tune with their culture'.

The new birth of public health in England, to which the industrial revolution gave rise, was very different – again reflecting the prevailing philosophy of local government and distrust of autocratic rule, however benevolent. Edwin Chadwick (1800–90) is justly famed for hammering relentlessly home his conviction that health depended upon sanitation. Chadwick's circulation of vital fluids, from pure water to purified sewage-protected water courses; pipes, drains, and sewers, intact and inviolate; purification and return to the soil – has been as momentous for man's progress as Harvey's discovery of the circulation of the blood.[10] If Chadwick were alive today he would find nine-tenths of the world still suffering the torments of intestinal infections from which Europe and the New World, in following his teachings, have escaped. Nevertheless Chadwick's claim to our undying respect might rest even more firmly upon his less considered teachings: the use of local govern-

ment in public health administration, and also of the medical officer of health as a specialist adviser, both of which gave rise to far-reaching effects.[10] The people began to participate in their own health protection – by franchise from among themselves for voluntary service on local Boards of Health; and supplying the means to finance the services needed to remedy sanitary evils out of their own pockets. Doctors, locally appointed, advised the boards in the discharge of functions placed upon them by Parliament. Their appointment soon became compulsory and their tenure of office protected. This is the English scene – with its attention focused unromantically upon sanitation – which was Chadwick's gift to the world.*

Throughout Europe, North America, and the British Dominions the general plan of organization has followed, not of course consciously, one or other of these two prototypes, although Edwin Chadwick is recalled to mind now only as the domineering policeman and the name of Johann Frank, benevolently academic, has been virtually lost to the world. France, Spain, Austria, Germany, Italy, Belgium, and the Scandinavian countries all developed their public health along paternalistic lines. To this, no doubt, the French Revolution added an appreciable impetus. No sort of uniformity exists, and each European country has grown apart from its fellows in a hundred different ways; but in the background can be seen the web of centralization, the reliance upon the State official. Perhaps France is now the greatest example with its public health services based on the *département* under the supreme authority of the Préfet, '*fonctionnaire nommé par l'Etat*', and with a medical director on the staff of the central organization.[17] Speaking in 1954 of the failure of the *Conseil Départemental d'Hygiène* established in 1902 to advise the Préfet, Pequignot[37] says significantly that since the method of dealing with questions of techniques in preventive work is essentially by means of national circulars, 'it is difficult to imagine a policy of official services different in the Savoy and in the Morbihan'. In England it would be difficult to imagine them the same.

The paternalistic countries also tended to develop Frank's ideology of social medicine, with emphasis upon hospitals and medical care. The French prefects received their first national circular about hospitals in 1840.[38] Most if not all the European countries began to build State hospitals at an early date. As early

* See Brockington, C. F. (1965), Public Health in the Nineteenth Century. Edinburgh : E. & S. Livingstone, for a full account of this development.

as 1931 Newsholme's report spoke of 'an admirable system of municipal and county hospitals throughout every part of Denmark'.[35] Both Denmark and Sweden, he said, had 'a hospital system supported out of the taxes, which removed hospital treatment for all needing it from the category of problems still to be solved'. With Germany as the pioneer, European countries also tended early to insure, voluntarily or compulsorily, for care in sickness by the medical practitioner. Denmark succeeded in the seemingly impossible task of obtaining virtually complete cover on a voluntary basis. Perhaps we can see in this also a reflection of Frank's concern for poverty as a cause of disease, which he put so eloquently in his oration as Dean of the Medical School in Austrian Lombardy (1790).[19]

In contrast Chadwick's emphasis on disease as a cause of poverty – 'the pecuniary cost of noxious agencies'[40] as he said – led to sanitary measures. England came much later (1911) to adopt insurance, and the U.S.A., objecting to its organization by the State, is still without complete cover. Thus while Europe gathered its administrative forces at the centre and attacked the problem of how to get the sick treated, England and the New World got down to sanitation with the responsibility firmly placed upon the shoulders of the local citizens. Chadwick rubbed their noses brutally in the dirt.

THE AMERICAN SCENE

The influence of England on America, although with long-delayed action, was striking.[3] The Shattuck report (1850), if it had had a greater appeal to the emotions, might have been written by Chadwick.[31] Shattuck followed the English report in most of its main recommendations, including that for full-time medical officers of health specially trained and qualified in public health and independent of private practice. 'Statistical investigations', he said, much as did Chadwick, 'are our best friend and severest critic.'[31] As a result English and American public health have had their roots in biostatistics.

At the American Sanitary Convention of 1859 the finger was pointed across the Atlantic to Chadwick and the 'noble Government of England', noble for what it was doing to promote health and preserve life.[51] In 1876 the first President of the Massachusetts State Board of Health said that England, which 'had far outstripped any country in the world in the direction of State Medicine', exerted by far the greatest influence upon America. 'When the time came

for the American cities to pass sanitary ordinances', he said, 'they did so in the tradition of English Common Law.'[25]

English and American Public Health, despite many differences, are alike in favouring local government with considerable autonomy. A recent study of inter-governmental relations in the U.S.A. has said:[60]

> The role of national government is confined primarily to providing plans, financial aid, advice, and supervision; and in varying degrees this is true of state governments as well, although they provide also most of the legislation and sanctions for public health. In most communities and many rural areas the direct public health functions are performed mainly by local officials, though with the assistance, support, and supervision of state agencies; and it is the hope of most public health authorities that this system of primary local responsibility will be extended to cover the entire country.

The development of the public health movement follows so closely the English pattern that Welch's classical dictum that the Panama Canal and the public health nurse have been America's two great contributions to public health, could, with modification, have been coined for England. Both countries also used voluntary effort for much of the pioneer work. Hanlon writes:[25]

> While the official, governmental, or public health agencies were still in the process of development, a complementary and supplementary force appeared in the form of the voluntary non-official health agency . . . spurred by public interest, desire for private philanthropy, and sometimes by impatience or dissatisfaction with governmental programmes, over 25,000 such agencies were established during the ensuing half century (after 1892).

The same could be written of England.

VARIATIONS IN DEVELOPMENT WITHIN THE EUROPEAN MOVEMENT

Yet the countries that have pioneered public health are remarkable rather for their differences than their similarities. The control at the centre has assumed many forms and no two are alike. The public health of Denmark, which has always been in advance of the world, has functioned without a Ministry of Health, nor even a separate health department within an existing ministry. The Sundhedsstyrelsen, 'the chief supervisor of public health and nursing', is a separate institution which must be consulted by the various departments of the central administration whenever matters requiring expert professional knowledge are to be decided.[18] Some countries with less corporate spirit might easily fail to develop under such a loose rein.

Where a central government department of health exists there

is no known instance of its embracing all health matters, and the extent to which functions are spread over other ministries varies greatly. Thus, in the U.S.A. the Children's Bureau and the Public Health Service form independent units in the Department of Health, Education, and Welfare – in which are grouped those agencies of the government whose major purposes are to promote social and economic security, educational opportunity, and the health of the citizens of the nation. The Children's Bureau, created by Congress in 1912, is responsible for children and to some extent mothers; it was directed to 'investigate and report upon all matters pertaining to the welfare of children and child life'. Much of its activity is indirectly in the field of public health.

At the periphery there is likewise every variation. The development of Local Public Health units has been, to all appearances, quite haphazard. In England they began to be formed in 1831; the country was covered completely in 1872–5.[10] In the U.S.A. they began in 1793; but despite the Shattuck Report (1850), the concept of a well-organized health department, supervised by a whole-time Medical Officer of Health, was not widely applied, in the U.S.A., until the 1920s.[42] Three-quarters of a century lapsed after the first Board of Health in Baltimore in 1793 and the foundation of that of Boston in 1873.

The power wielded by the local councils and their officers has also been developed along different lines. The complete autonomy of New York or Baltimore, whose charters make their health departments entirely independent of the State,[25] has to be seen in contrast with the relative subservience of the council of a French *département*. An English city or county council, or a Swedish county, lie somewhere between. The Swedish autonomy at the periphery, as in Denmark, is limited by the central appointment of governors, prefects, or chairmen, and, of course, of the medical adviser.

The system of local units for health administration in Holland, which relies on what might be called voluntary local authorities and is unique,[1] illustrates well the great variety in organization which can exist. Holland has a chief medical officer responsible to the Minister of Social Affairs with twelve departments, all but one headed by doctors. In each province there is one 'Medical Inspector of Health', who is responsible, without executive authority, for what happens in public health in his province. Public health practice, as it concerns maternity and child welfare, tuberculosis, child guidance, mental health, and many forms of child care, is conducted by

voluntary agencies – the Green, Yellow, and Orange Cross societies. These are organized on a village, province, and state basis. Since most of their funds are derived from the government, the medical officer advises their central departments, and the provincial medical officers exert their influence locally. The doctors at each level are thus able to guide the service, in much the same way as under the grant system in England or the United States.

The extent of the power to be wielded by the medical officer of health is strikingly different, both as between different countries and often within the same country. The health commissioner in an American city governed on the managerial system, making and executing his own laws – but generally liable to removal by political whim – will enjoy a very different daily round of life from that of a nominated official of the State on the continent of Europe. The British medical officer of health, whose duty it is to discover everything in his area that may be prejudicial to the health of the people, virtually independent of control from the centre and yet the servant of a locally elected council with its own chairman, stands again in a category of his own. Symbolic of the whole variegated picture of public health practice throughout the pioneer countries are those large areas of the United States of America where no health department, or health office, yet exists.[14]

The pattern of administration has been further complicated by individualistic trends in devising new fields of action. 'Hitherto, most countries have evolved measures for reaching their hygiene objectives only as each pressing need has emerged.'[35] Not even Frank's omnibus of social medicine, the work of a lifetime, could stamp a blueprint which all would follow. This is understandable, when human needs and circumstances vary so greatly and are so constantly changing. Public health has to be paid for, and the money chests are opened reluctantly. Yet the differences in approach and rate of advancement are difficult to explain, except in terms of the whole philosophy and systems of values of a people. Scientific knowledge has been at everyone's disposal. Yet Denmark began a system of gratuitous treatment of venereal disease for all patients, irrespective of social and financial status, in 1790, 126 years before Britain (1916). In Switzerland gratuitous treatment began as late as 1931, and then for the indigent only; so that 'the struggle against venereal disease must be described as in a relatively early stage of development'.[35] France made vaccination against smallpox obligatory 105 years after Jenner's discovery, and nearly a century after Germany. Sweden pioneered vital statistics.

As early as 1758, Sweden had an official statistical commission charged with the tabulation of details received from the clergy. She now has the longest continuous series of vital statistics of marriage, births, and deaths in existence. Sweden likewise began the notification of sickness much in advance of other countries. In Holland and Scandinavia the midwife reached professional status in the early part of the century; disasters in pregnancy in these countries had fallen to a low level shortly after the end of World War I, to the envy of others less fortunate. In contrast the United States of America has not found it necessary to develop the midwife. Examples could be multiplied many times.

Few things, indeed, are so striking as variations in development of public health. While England concentrated on sanitation, at least from the time of Chadwick's Public Health Act (1848), France hardly approached the subject before the Law of 1902, which established at one sweep all that painstaking trial and error and empirical action had achieved across the Channel in the preceding half-century. Even today, as Pequignot has said, France's sanitary services, although in advance of under-developed countries, lag behind those of 'les nations plus modernes', such as England and the United States.[39] Equally striking has been the unevenness of the advance towards the acceptance of medicine as a social science, and of medical and hospital care as an essential agent in public health. While Scandinavian doctors accepted a co-operative rôle from the nineteenth century onwards, the professions in England, the U.S.A., and France have fought rearguard actions to avoid what they considered to be an infringement of their liberties.

CAMERALISM *v*. LOCAL AUTONOMY

Much has been said about the advantages and disadvantages of the two main European systems of public health administration. Newsholme, speaking particularly of France (1931), said that the system implied 'a shackling of local enterprise, and an influence tending to keep at a very low ebb the training of local patriotism'.[35] Perhaps the lag in French sanitary services, to which Pequignot referred, may be due to this, since local autonomy in a matter so rooted in local habits and customs will be of particular significance. Particularly disheartening can be the need to refer to higher authority on small matters of expenditure. 'If a public lavatory is needed, this may involve an addition to the budget and the central power must approve.'[2] Yet it would seem that the Clochemerles of

France, as elsewhere, have escaped from this dilemma by one expedient or another. In Denmark and Sweden the solidarity of national culture – above all the acceptance by the medical profession of social and preventive medicine and its participation in a social service – has done much to remedy the inadequacies of bureaucracy.

On the other hand, local government in public health, which relies in both the United Kingdom and the United States of America on local initiative, cannot escape the defects of its virtues. Some might say that what is gained on the swings, in participation by the people and by local initiative, has been lost on the roundabouts in a muddle of inefficient units. In practice, neat parcels of administrative territory, the legacy of paternalism on the European continent, have many advantages as a basic framework of public health, in comparison with the haphazard areas of local government in the United Kingdom, or in the United States of America, as indeed the present position of public health practice in the U.S.A. gives ample proof.

Thus, for example, the Minnesota State Board of Health, which consists of 'nine members, learned in sanitary science, who shall be appointed by the Governor to serve without pay for overlapping three-year terms', has all the powers for the promotion of health of the people of Minnesota which the lawyers of 1945 could devise.[60]

> The State Board of Health shall exercise general supervision over all health officers and boards, take cognizance of the interests of health and life among the people, investigate sanitary conditions, learn the cause and source of disease and epidemics, observe the effect upon human health of localities and employments, and gather and diffuse proper information on all to which its duties relate. It shall gather, collate, and publish medical and vital statistics of general value and advise all state officials and boards in hygienic and medical matters, especially those involved in the proper location, construction, sewerage, and administration of prisons, hospitals, asylums, and other public instiutions. It shall report its doing and discoveries to the legislature at each regular session thereof, – with such information and recommendations as it shall deem useful.
>
> (Minnesota Statutes 1945, 1, 145.01)

In addition to these considerable general powers, other statutes exist to regulate the reporting of vital statistics; to order the discontinuance of dangerous pollution of drinking waters; to hold hearings and issue orders concerning 'offensive trades'; to inspect and license hotels, restaurants, resorts, and small boats; to examine, license, and administer the special laws relating to the licensing of plumbers, embalmers, and funeral directors; to provide instruction for the protection of maternity and infancy; to administer state

narcotic laws; and to inspect and license hospitals, rest homes, maternity homes, and homes providing care for the aged.

Finally, to complement its functions, the Board may issue regulations of permanent application having the force of law. It elects its own secretary, who may or may not be a member of the Board, but who is the executive officer of the Board – the state health officer, a medical man.[60]

But between the State Board of Health of Minnesota, keen to develop health measures at the highest level, and the long-suffering public, lies the local government machine. No less than 1,831 towns, 97 cities, and 87 counties are required to appoint Local Boards, and 649 villages have the right, if they wish, to do so. The stage, so admirably set for dynamic public health, now takes on the appearance of a chessboard for a slow and protracted contest, as each of the towns, counties, cities, and even villages places a piece. Obstruction, apathy, and vested interests can be doughty opponents of local interest and sympathy; the enthusiastic advance of the Central Departments may be lost in a stalemate.[60]

The inability of small local units to practise public health on modern lines is probably one of the reasons why the U.S.A. has remained so long without a complete health cover. Less than half the Minnesota towns, according to Emerson's Survey, had appointed a medical officer of health by 1945.[14]

> Since all towns, most villages, some cities, and even many counties have considerably smaller populations that can economically support public health programmes . . . it is not surprising that the law has not been enforced for towns.[61]

Similar difficulties have arisen in the United Kingdom, where the creation, by the Local Government Act 1871, of a pattern of sanitary areas, with a compulsory appointment of a medical officer of health, introduced uniformity – for a few years. But the evolution of counties and county boroughs in 1888, which were superimposed on the original sanitary areas, and the addition of the National Health Service in 1948, with further local bodies, Regional Hospital Boards, Executive Councils, and Management Committees, has quite destroyed it.

Thus it has come about that a multitude of units of local government does not mean that 'home rule' is necessarily as strong in practice, whatever the sentiment, as could be legally possible. At least in public administration, many of the local government units do not and cannot provide health programmes of much significance.[61]

Many answers to this difficulty have been devised. Minnesota,

and other American state departments, are developing 'state health districts', which temporarily at least replace local boards.[61] To bridge the gap elsewhere, the state duty of supervision and advice is widely interpreted to help the growth of local initiative and to provide essential services in the meantime; state inspectors of food and hygiene are at work all over the state – often, especially in the smaller communities, without making any official contact locally, lay or professional. The spirit of local government is not easily distilled from the raw product of a polyglot community.

THE INFLUENCE OF FEDERALISM

The inadequacies of local government may have been exaggerated in the U.S.A. by federalism. Federalism has had so marked an effect upon public health development that the analogy between two such widely different countries as Switzerland and the U.S.A., where state autonomy preceded a federal constitution, strikes even the casual observer.[35] Where the care of the public health is primarily the responsibility of each individual state, there can be little uniformity. The 22 almost completely self-governing cantons of Switzerland and the 52 sovereign United States present infinite variations both in enactments and in methods of public health administration.

Newsholme's study led him to indict federalism rather than local government for the slow development of 'public health administration in both U.S.A. and Switzerland'.[35] Public Health in both countries, he said, 'would advance more rapidly if these were organized on a minimum order of uniformity, with full freedom to experiment and extend beyond the stage of minimum equality of establishment'.[35]

This may have been true in the early thirties. But more recently grants-in-aid, introduced by the inspiration of Surgeon-General Parran, have been responsible in America, as for long in England, for vigorous development in public health programmes – despite, at least in the U.S.A., strong resistance from the local bodies that they have been designed to help. The U.S. Public Health Service and the U.S. Children's Bureau charged by Congress with the administration of the majority of the federal grants-in-aid for public health purposes have been constantly called upon to convince their beneficiaries that their freedom of action would not be unduly limited. The development of uniform services within a federal system has been well illustrated by the National Office of Vital

Statistics, first established in the U.S. Bureau of Census in 1950 to encourage the States to develop a uniform system of registration and tabulation of vital data. By this means the national collection of vital statistics covered all states by 1953.

COLONIAL SYSTEMS

The influence of the European movement spread also to the colonial dependencies, mostly to peoples who had no understanding of and little sympathy with the basic philosophies upon which it had been founded. Nevertheless Africa and many parts of the East, including some countries to be described later for their independent efforts, thus received a first inoculation with the doctrine of public health, with services developed on the pattern of the parent country. Public health in these far-distant regions has inevitably been a watered-down version of the original, particularly in the British system in which the Colonial Office tended to take up a paternalistic rôle. The forces which Frank and Chadwick had released, reinforced and canalized by the great men of many nations – William Farr and John Simon, Lemuel Shattuck and Stephen Smith, Parent-Duchatelet, to mention but a few – have met the resistance of people with entirely different philosophies of health and little scientific understanding. Europe has had to learn how much public health depends upon a willing co-operation of the people; and this in turn upon standards of living rising with technological development.

No adequate description can be given of services provided in so many different ways and under such varied circumstances; but it may be possible to see in the practice of public health in India and Ceylon something of what has been happening everywhere. In both these countries, as elsewhere, the burden of sickness, and the absence of social services, has proved to be an overriding consideration.

India

The Bhore report (1946) says of India, comparing it with European countries:[26]

> In India the rate of progress in health administration has been much slower . . . reference may be made to one aspect of health administration in which India differs from other countries. In the latter, the provision of medical relief for the community has largely developed in the past through the efforts of voluntary agencies and through the growth of an independent medical profession. In India, on the other hand, medical relief was accepted

by the State as its responsibility from the beginning. Indeed, it received much more attention than the development of those preventive health measures which may collectively be termed 'public health activities'.

When the Commissions of Public Health in Madras and Bengal (1864) put forward far-reaching recommendations, which included the employment of trained public health staffs in towns and districts, these came to nothing. Sanitary commissioners were appointed to the provinces. But 'each provincial sanitary commissioner had only one assistant to work with him and, apart from this lack of adequate trained staff, the main emphasis continued to be laid, during the period, on the development of medical relief. Medical administration did not give preventive medicine its place.'[26] The reason appeared to be the vast numbers of India's sick, 'so obviously demanding attention that it was to the practice of curative medicine that by far the majority of doctors of the State health service turned'.[26]

This same appeal of the sick must have happened in all underdeveloped countries. It still happens today. But it is difficult to find in this the whole answer. The difficulties of excessive sickness applied earlier, if in a lesser degree, in the homelands too. It is true that the development of hospitals, even if only as places of refuge or isolation (see p. 105), had reached, in Europe, a point where minimum needs were satisfied. The average conditions, too, in the new industrial areas, if shocking to European eyes, were in advance of those in India. Great differences existed in the cultural and social background. There were doctors of a sort in England, and none in India. All these considerations were formidable obstacles, but constituted no absolute barrier, to the application of the Chadwick philosophy. Some part, at least, of the genius of England's pioneers in public health should have been India's. Nowhere in the world can peoples have existed more in need, in desperate need, of Chadwick's sanitary science. And yet the country which gave birth to this idea could not give it to India. England, that had set aside medical care and hospitals as of secondary importance to the hygiene of the environment, exalted them in India to an exclusive and privileged position. The driving force of self-interest, which so greatly influenced the development of public health in home territories (see p. 133), was no doubt largely lacking in administrators overseas.

The development of public health in any real sense began in India only in 1921, after the Government of India Act (1919) had transferred health administration to the provinces. This late entry

of India into the field of public health action, whatever the causes, can be compared with that of the United States of America. As history has shown so often, Public Health, illogically, is not accepted as an immediate need by developing societies; the fight for existence in both new and old environments can be all-absorbing. Disease and death then become no more than incidents in a life of toil. When life is cheap, the motif of self-interest is slow to develop and the vicious circle of disease and poverty continues unbroken.

In the years following World War I, Public Health in India, under the new directors of public health, began to develop, particularly in certain provinces. But in many parts the subservience of preventive to curative medicine continued to exercise a baneful influence. Preventive health duties formed part of the responsibility of the Civil Surgeon in each district. 'The duties of the latter in connexion with medical administration as well as his professional work in the district headquarters hospital and his private practice generally take up so much time that the public health functions which he is required to perform remain largely undischarged.'[26]

The drive to clean up the insanitary environment which kept England intensely occupied for the latter half of the nineteenth and the first quarter of the twentieth century – legislating for health in a hundred or more enactments, developing local government within a slowly extending 'franchise', and training medical men and medical auxiliaries in public health techniques – passed India by.

Nevertheless, England's public health practice can be seen represented in a hundred ways in the Indian institutions – in maternity and child welfare, midwives, health visitors, sanitary inspectors, school health, factory health – even if imperfectly developed. India may have waited a half century or so, but in the end local government began to administer 'general sanitation, control of infectious disease, regulation of housing construction, control of purity of food and water supplies, abatement of nuisance, and registration of vital statistics. Speaking generally, all local bodies were given power to appoint and control their own establishments, including the health staff'.[26] India even reproduced the English and American mistake of having areas which were too small for effective public health work, so that the Bhore report recommended the abolition of many and their replacement by district health boards. Characteristically, the security of tenure of the medical officer of health was reproduced by a statutory requirement that the provincial

government must give prior sanction to his appointment and dismissal.

The English obsession with local government – its autonomy, its integrity, its dynamism – may well be her greatest gift to India's public health. Her belief in sanitation, as the first requirement of any public health system, is a close second, for it would be wrong to conclude from the obvious preoccupation with curative medicine that the sanitary ideal was wholly ignored. At the time of the Bhore report the vast majority of areas in India did not have the benefit of safe water supplies; in a total population of 350 millions the number living in areas normally served by sewers 'was probably only seven millions'.[26] Yet Chadwick's enzyme was at work. It is more remarkable that there were seven million under the protection of an adequate sanitary system than that 343 million were without. With time, and particularly with nationhood free from foreign domination, the whole can be leavened.

Ceylon

Public health practice has varied in every colonial territory. In Ceylon, so near to India, the introduction of an organization designed to protect public health was similarly delayed, for reasons which could not differ greatly from those in India or in any other colonial territory. A sanitary department, with full-time medical officers of health in large districts, was not established until 1913.[43] Since this time progress in many ways has been greater, so that Ceylon illustrates what must have happened in many other colonial territories, the advantages of enlightened local leadership. In 1926 the first of a series of health units, covering 40–80,000 population, was established. The development was modelled on America, not, as might have been thought, on the British pattern. Health units have been the basis of continuous public health action in Ceylon – in surveys, statistics, health education, maternal and child health, school health, sanitation, and control of disease – for 30 years. The favourable state of the island today and the ease and readiness with which it has adopted modern public health services after World War II, is not a little due to this fortunate development.[33]

JAPAN

The colonial dependencies apart, the public health movement, despite its practical advantages, hardly spread beyond the immediate spheres of influence of the Western European countries in

which it was born. The East – Middle, Near, and Far – except where colonial services operated, lived up to its sobriquet and continued unchanging. To this generalization there is one obvious exception – Japan. Late in the nineteenth century Japan came under the influence of Germany; as a result of this she adopted something, if not all, of the public health practice of the paternalistic school. She established public health almost literally as a police system and as part of the local police service, with such peripheral health administration as could be imposed upon an exceptionally complicated social background having its roots in antiquity. As in Germany, health insurance was a prominent feaure, and, unlike England, sanitary science, including housing, remained largely neglected. The 46 prefectural police departments took their orders from the State; and the medical officer of health – sturdily independent and outspoken in his criticisms of sanitary evils, who has featured so strongly in the English scene – was absent.

The services in Japan were never more than a general reflection of the European scene. The emphasis on hospitals and medical care was absent – possibly because Japanese culture included an exceptional ability to withstand hardship and was affected in its attitude to human survival by many influences, including a rapidly expanding population.

Local health departments on the European pattern began in Japan only in 1938. By 1956, no doubt encouraged by American advisers who saw the possibilities of decentralization which these offered, 783 public health units had been developed throughout the provinces – undertaking health education, vital statistics, improvement of nutrition and food hygiene, environmental sanitation, public health nursing, maternal and child health, dental hygiene, laboratory tests, and the prevention of tuberculosis, venereal disease, and other communicable diseases.[29] American influence – which has not been so great as at first it might have seemed – is to be seen chiefly in the reorganization of the Ministry of Health and Welfare and the creation of a prefectural health department apart from the police. The 'health officer' is now an important, if badly paid, servant of Japan's public health.

The success of Japanese health practice, despite many inadequacies, has been far from inconsiderable. Her achievements in recent years – as, for example, the sickness surveys which she shares with Canada, Denmark, Britain, and U.S.A. – give promise of rapid progress. Yet in the background are to be seen – a little incongruously perhaps – the shadowy figures of Frank and Chadwick.

As with Ceylon and India and many other countries to which the European movement spread – even if only as the faint outer ripples of an ever-widening circle – Japan benefited from philosophies alien to her culture and development.

THE FINAL PATCHWORK

These are but pen sketches. A richer and deeper picture might be painted if the canvas were available and the time opportune. In machinery and in content, public health – the basic institution created and maintained by society to preserve the life and health of the people – is, in Europe and the New World, a many-splendoured garment. The philosophy of public health has been given many interpretations; and the human being – subjected broadly to the same occupational, ecological, nutritional, psychological, and other hazards – has nowhere been given any uniform protection. The visitor from another planet might well ask upon what general plan the developed countries had used their new technological and social weapons in the interests of Public Health. Nevertheless, although the practice of public health is, and is likely to remain, so varied, there has been a growing together. Each nation has incorporated new ideas to meet the needs of its developing society at varying dates and times; but the final patchwork which each country presents – sanitary science, control of communicable diseases, protection of vulnerable classes, biostatistics and surveys, health education, mental health, welfare of the aged and child care, industrial hygiene, etc. – is not now dissimilar.

Recent developments in comprehensive medical care have tended to hasten the development of a common pattern. Most of the countries which began their public health in the nineteenth-century movement are once again in the throes of revolutionary thinking – towards the new goal of social medicine – which involves public health in curative medicine and vice versa. The concept of good public health now demands a full medical service, at home and in hospital, available to every citizen irrespective of ability to pay. Britain, Australia, New Zealand, Canada are engaged, more deeply even than the Scandinavian countries where such developments were pioneered, in operating schemes of medical care, financed by the State or by insurance, according to taste. These have resulted in increasing emphasis on the hospital, a phenomenon which every country in one form or another has experienced. The future in Europe and the New World may well become a fight to prevent the hospital from taking control.

CHAPTER 15

Newcomers to Public Health after World War I

AFTER the First World War there were three particular newcomers to the public health scene – Yugoslavia, Turkey, and Russia. They are to be included together in this account because each set out – in very different ways – on the same track to technological development, seeking to achieve in a few years that state at which Europe and the New World had arrived after perhaps 200 years of evolutionary change. Yugoslavia, Turkey, and Russia sought to pull themselves up, as it has been said, by their own shoe-strings. It would not be true to say that these countries had previously been unaffected by outside influences, or that they had done nothing in the field of public health. In Turkey, where the Ottoman Empire had left the care of public health largely to religious and other voluntary organizations,[48] perhaps least had been done. Russia certainly had the Zemstvo, a form of local government body, with salaried doctors, who were responsible for both curative and preventive medicine in their districts. Large parts of Yugoslavia had taken part in Austrian public health developments. But in fact, despite everything that had gone before, these three countries in 1920 presented the typical picture of the underdeveloped world – high infant and child mortality, low expectation of life, widespread infectious and nutritional diseases, almost complete lack of sanitary scence, with practically no measures to combat widespread evils. In the post-war movement for development, public health was regarded in each case as a first consideration. Each country wiped the slate of past endeavour clean, and drew out afresh a plan for public health practice. The public health of these countries in consequence differs in many fundamentals from the European pattern which we have already considered. The fact that these bold enterprises have now been in operation for nearly half a century gives them greater fascination.

Many, as Newsholme has said,[35] must 'envy Yugoslavia in having begun its work without the impedimenta which undue multiplication of units and administration implies'; and indeed Russia and

Turkey too. Nevertheless, other countries have had the same advantages without seizing them. Russia and Yugoslavia resembled India in this, as well as in the extent of disease, and in the many different races and civilizations, diverse in character and development, of which they were composed. It is significant that the recommendations of the Bhore Committee in 1946 would produce a service in India very similar to those of Russia and Yugoslavia. The Russian and Yugoslav services, like the writings of Bernard Shaw, seemed more revolutionary and esoteric when first produced than they do today. The principles on which they are based – complete integration of curative and preventive medicine, medicine as a social service, the predominance of preventive medicine, health centres as the basis of operation, and community participation, taken together, shocked Europe, as did *Pygmalion*, after the First World War; yet they go little beyond the statements made in the various White Papers which preceded the National Health Service in Britain. Many have been advocated, and some operated, for some years in different parts of Europe.

The health centre, combining medical care with preventive work, which is perhaps the most distinctive feature of the Russian scene,[9 16] as to a lesser extent in Yugoslavia[11] and Turkey,[12] was recommended, independently, by the Dawson Committee (1920) in England.[24] After the government White Paper of 1944, which reflected the views of a succession of planning committees, it was incorporated in the National Health Service Act (1946). Similarly in South Africa the National Health Service Commission (1944) recommended a service based upon health centres, each serving about 25,000 people.[20] The South African scheme was to be a family health service – as already demonstrated in their pioneer health centre at Pholela. But in England and South Africa these ideas came to nothing. Medicine perhaps was not sufficiently a social service, or maybe, as in South Africa, the pull of curative medicine towards the hospital was too strong.[20] The European Conference on Rural Hygiene convened by the League of Nations Health Organization (1931), in which 23 countries participated, recommended health centres wherever 'a modern public health organization is to be created in new territory' (see p. 174). Health centres were recommended by the World Health Organization Expert Committees on Public Health Administration (1952–54),[52] and during the Technical Discussions of the World Health Assembly, 1954.[53] The key to the Bhore report recommendations for India was the primary health centre with two medical officers,

four public health nurses, four midwives, four trained dais, two sanitary inspectors, and two health assistants.

The union of curative and preventive medicine, administratively, has been a long-cherished ambition of most health planners. First advocated *officially* in the report of the Dawson Committee (U.K.) in 1920 (see p. 161), it has appeared in many subsequent reports and writings in different parts of the world. 'Once the essential environmental and infectious disease services have been completed, health will not further progress to a satisfactory level until preventive and curative medicine are brought under a single co-ordinated administration which includes the general practitioner. . . .' (Grant.)[23] 'The co-ordinated application of curative and preventive measures can alone help to secure an adequate control over the incidence of disease' (Bhore).[26] Many have also believed that preventive medicine should come first in planning. Thus it has been said that *'The primacy of preventive medicine is to be maintained by having health-minded rather than disease-minded persons responsible for over-all planning and allocation of community resources'*[23] (Grant). The instances could be multiplied many times. Thus, in the mid twentieth century, there is little that is remarkable in the principles on which Russia and Yugoslavia have operated their public health services – except that they were put into practice so long ago.

The first outstanding feature of the Russian scene is the policlinic – perhaps better called a health centre – of which some 30,000 have been established in industry, and, separately for children and adults, outside in the community. The health centre combines preventive and curative work for a surrounding area. It employs, on a whole-time basis, three types of doctors: (1) general practitioners who cover a defined sector, (2) 'specialists' who work in the centre in various branches of medicine, and (3) public health experts. The centre does most of the work which in Europe and America would be channelled in hospital outpatient departments; so that the hospital lies, as it were, in the background, as a second line of defence, leaving to the health centre the bulk of the work of maintaining health and caring for the sick. Preventive examinations are conducted, not only of schoolchildren, mothers, and infants, as in the Western world, but also of adults, particularly in industry, using a team of specialists – a process known as dispensarization. Factory health, school health, maternal and child health, other special branches of public health work, are based upon the centres. The training of doctors has been designed to use medicine as a social

service. Much more time is spent than in the Old World on training students in the principles of public health. Furthermore, students can separate into three streams, so that the final product is adapted for general medicine, for sanitary and hygiene work, or for paediatrics. Also in the sixth year, until 1955, students specialized in one or other of the branches of medicine, in order to be able to occupy special posts in health centres – after a period as general practitioners.[8 45]

The second feature is the use of soviets in public health work. Such local committees of citizens exist in streets, blocks of flats, and other units. In Stalingrad (now Volgograd) in 1956 there were said[9] to be 400 and 70,000 in the whole of the U.S.S.R.

> 'These undertake social welfare work under the direction of a committee of the Stalingrad Council, with a prominent member as chairman. They are responsible for sanitary matters, for taking steps to see that those in need of care get it; for work in connexion with problem families and marital disharmony; for following-up schoolchildren (in collaboration with parents' committees) and much else.'[9 34]

Each Republic has a central health administration, under a director of public health, which directs and controls the whole of the health services, including medical education and research. But the control of all the republics from Moscow tends to produce a uniform pattern – somewhat on the French plan.

Russian health services, clearly unique, may be an expression of Russian political thought; but they bear in many ways the imprint of a powerful but unknown mind. They are of a piece; designed to an end – the protection of the health of the Soviet citizen from birth to death. Health centres, medical education, and soviets, fit together, as one logical whole.

In contrast, in Yugoslavia the presiding genius is well known – Andrija Stampar, the first head of the hygiene section of the Ministry of Health in the newly-formed Kingdom of the Serbs, Croats, and Slovenes. The history of the new Yugoslavia has been chequered. One regime has followed another in bewildering succession. After the Second World War the country became communist. But through all this period, little affected by changes in political systems, the imprint of Stampar on the health services stands out. Most striking was the creation, in each of the nine provinces, of a *central hygiene institute*, which has combined administration and research. By this means, the administration of all forms of public health work – epidemiology, industrial medicine, bacteriology and parasitology, food hygiene, maternity and child welfare, nutrition, etc. – has been

kept in touch with scientific investigation. In 1931 Newsholme[35] found this combination to be eminently satisfactory, with little risk that the administration would become 'stereotyped and rigid', so long as it was linked with the scientific investigation of current problems. Twenty-five years have borne out the truth of this prediction. The Institute of Hygiene, in the Yugoslav form, has, no doubt, a lasting message for all countries. Stampar also started a section on social medicine in the new School of Public Health at Zagreb. At this very early date public health teaching included 'the study of the biologic and anthropological peculiarities of the people in general and of the different groups'.[35] As in Russia, but without the peculiarities in medical training, health centres were established as the focal points of combined preventive and medical care of the community. Both Russia and Yugoslavia, in their different ways, have subordinated medicine more obviously to the needs of the community, requiring that it shall be a social service working with the people. The wisdom of an enlightened authority has imposed upon the people what 'local participation' and initiative – as a deliberate democratic choice – has found difficulty in doing.

Turkey differed only in its social pattern from its two near neighbours. It had, and still has, the same familiar background of poverty, excessive disease, and scarcity of trained personnel – a handful of doctors and virtually no nurses or medical auxiliaries – which is familiar to a large part of the under-developed world. The death rates from all or most infectious diseases were high, although their true magnitude was, and still is, unknown from lack of valid statistics. The Republican Government in 1920 established the first real health service that the Turkish people had seen, and in the intervening forty-seven years, largely unaffected by wars, Turkey has made great progress in health. The successes have lain largely in those spheres where centrally run schemes could operate successfully, as in the control of malaria, venereal disease, and trachoma. The tradition of local autonomy and participation, and the will to subordinate curative to preventive medicine, were absent.[28]

The Ministry of Health and Social Assistance controlled the organization, operating through directors of health as their representatives in the provinces. The Governor of the province was head of a provincial public health board composed of officials. Corresponding district boards existed.[47] The service was thus almost completely bureaucratic, without the saving grace of the soviets. As has been said, after 1920 'a campaign almost on military lines was organized to attack the problem of disease'.[48] But the rate of increase

of doctors, nurses, and other health personnel has been slow; and the training of doctors particularly has lacked the preventive bias which Russia and Yugoslavia, each in its own way, introduced. The spectacular appeal of curative medicine has been great, and modern critics[28] have reported an exaggerated and disproportionate hospital plan. When so much of its preventable disease is directly attributable to low standards of hygiene – trachoma, typhoid fever, worms, gastro-enteritis – the first need is for basic sanitation. As Lightbody said, in his critical analysis of Turkish services:[28]

> As fast as sanitary inspectors can be properly trained, their energies should be applied to the abatement of nuisances, public education on the value of clean surroundings, the protection and improvement of water supplies, better methods of sewage and refuse disposal, and inspection of housing and food. Urban communities should be provided with water purification plants, or at least emergency chlorination plants. Regular inspection and frequent bacteriological analysis should be made of all major supplies of water . . . inspection of supplies from source to consumer . . . greater attention to the effective enforcement of regulations regarding septic tanks and cesspools and to the controlled collection and dumping of refuse, is vital in towns and hardly less important in villages . . . etc.

But this unglamorous and unspectacular ideal still awaits fulfilment. The spirit of William Duncan, the first medical officer of health in England, and one of the pioneers of the Chadwick era, would be a notable addition to the fight against disease in many Turkish cities.[6] Yet Turkey, like Russia and Yugoslavia, has adopted the health centre as the focus of preventive and curative work, showing again that the health centre is more easily achieved in an authoritarian regime. By the end of 1955, 181 such centres were in operation. But Turkish health centres are still to be found in rural areas only; here they have the distinctive feature of incorporating a rural hospital, not unlike that described by Bridgman.[4]

In each of these three under-developed countries, the drive towards public health has produced great improvement; but for various reasons Russia has outstripped her neighbours. Here the health picture, if statistics were available, would almost certainly be seen to have been transformed into that of a developed country.

CHAPTER 16

Newcomers to Public Health after World War II

THE WHOLE WORLD ENCOMPASSED

AT the end of the Second World War a further movement towards public health began in sovereign states, new and old; of these the most notable were Indonesia, Burma, Thailand, the South American States, China, India, and Pakistan. This period was remarkable for the influence of the World Health Organization, described later (Chapter 19), and of other specialized agencies of the United Nations. Of this late awakening, urgent and impulsive, little concrete can be said: certainly of China, whose 450 millions had virtually ignored the practice of public health for 2,000 years, we know hardly anything.

The general range of health problems which faced these countries exceeded those of Russia, Turkey, and Yugoslavia in the 1920s, and even those of Europe in the early nineteenth century (see Chapters 3 and 4). Communicable and nutritional diseases abounded. Intestinal infections and worms of many kinds were almost universal. Special diseases, such as yaws, leprosy, or filariasis, prevailed over wide areas. Widespread lack of sanitation caused untold illness. In nearly every part of these vast regions, childbirth remained in the hands of village handywomen, with deplorable consequences. Thus, in Indonesia a woman died in childbirth every quarter of an hour, and a baby every minute.[46] In Thailand, motamnys were still attending five out of six deliveries in 1958, although over a thousand midwives had been trained, mainly for work in the jungle, since the Second World War.[7] Doctors, nurses, sanitarians, and other auxiliaries hardly existed. Indonesia in 1956 had one doctor only to 55,000 people.[30] The social framework upon which health services depended for their support had in most cases hardly begun to develop. Thus the means to meet the burden of sickness and suffering were as limited as its needs were great; while the absence of a scientific background, and the existence of deeply rooted customs and beliefs, introduced difficulties which Europe at least has experienced relatively little (see Chapter 6).

Despite all such evidence of preventible disease, the spectacular appeal of curative medicine now hypnotized the developing world. The hospital, increasingly the scene of drama in Europe and North America under the influence of advancing technology, seemed to the uninformed to answer all imaginable problems of health. The lessons of European medicine in the sixteenth, eighteenth and nineteenth centuries, if ever learnt, were forgotten. The building of hospitals generally exceeded the rate at which trained personnel, particularly nurses, could be provided; and the shortage of nursing staff, exacerbated by the reluctance of women to take up this profession in so many parts of the world, added greatly to the hazards – much as had been the case in medieval Europe. The building programme moreover consumed a large fraction of available funds and thus encroached on the moneys available for developing public health in the field.

Yet public health did now begin in special and often limited forms. In countries where social development was insufficiently advanced to permit of an effective local organization, administration tended, although not universally, to be centralized. This was almost inevitable where the services consisted for the most part of special schemes to meet particular problems. In South America, despite the U.S.A. pattern of federal, state, and local services, with emphasis upon local control, the main responsibilities were, and still are, federal. The paternalistic pattern of the Continent of Europe, which came to South America via Spain and Portugal, was allowed conveniently to outweigh the American influence. The federal government of Brazil concerned itself with the solution of public health problems on a nation-wide scale with local services operated essentially as executive agencies at the national level.[36] Thus there were national services for malaria, leprosy, yellow fever, mental diseases, cancer, plague, and tuberculosis. The Federal Government also operated the Port Health Service, the Bio-Statistical Service, the National Drug Control Service, the National Health Education Service, and eight federal health commissions, the activities of each being limited to a group of states.

Such services were in addition to the supervision exercised by the central health department over all activities from nursing and sanitary engineering to hospitals.

Yet large parts of South America were still without any health services, and where these existed they were largely deficient in essentials – in Brazil there were municipal services, but these did not employ full-time health personnel.[36] The effects of this lack of

development in areas with so much preventible disease were far-reaching. Thus in Bolivia, where systematic vaccination began in 1953, 'although vaccine of good quality and in sufficient quantity is prepared, it was not yet possible to eradicate smallpox because of the lack of an adequate organization to carry out the vaccination campaign on a national scale'.[36] So it was in many places. Special schemes of various kinds helped to fill the gaps: in eight South American countries the reporting of communicable disease was done by 'reporting areas', which covered from one-fifth to four-fifths of the total areas of the countries. Public health had begun, but it was as yet 'a thing of shreds and tatters'. And in all that was happening expediency seemed to control events; there was a grave lack of National Health Planning (see page 168).

MODEL HEALTH UNITS

When so much needed to be done, so quickly, and the means were not to hand, nor the education or understanding, the obvious first step at the local level was to establish *model areas*, where modern public health could be put into practice (see p. 307). By this means, the great possibilities and the many difficulties could be seen at first hand; and some of the techniques, best adapted to the social conditions of the country, worked out. The model area was also a training centre for the staff without which no organization could be effective, and of which the under-developed world was in desperate need. New types of auxiliaries were evolved, for example, home visitors in Indonesia, health assistants in Burma, village workers in India.[13]

Such schemes were developed in many countries: the Jakarta and Bandung units (Indonesia), Chieng-mai province and Chonburi training area (Thailand), the Yankin Health Centre and the Demonstration Centre (Rangoon, Burma), the Singur health unit (Bengal, India), and the Colatina field training centre (State of Espirito Santo, Brazil) are examples. Many different projects were tried. The following description of the 'integrated health unit' at Bandung and Singur may be taken as examples:

The Bandung health unit 'covers a population of 1,200,000 people in 27 market towns and in about 300–400 villages . . . The unit headquarters staff consists of the chief medical officer, five physicians, one dentist, one sanitary inspector, one nutritionist, one public health nurse, and a statistician, together with administrative staff. There are eight health centres situated in eight of the 27 market towns – each with the following staff: one public health nurse as co-ordinator, one midwife for maternal and child health work, two

assistant midwives for home delivery, one nurse, one assistant nurse, and one elementary health educator.

'There are 64 village health sub-centres, each staffed by a village hygienist and a home visitor, both of whom are types of health auxiliary personnel. There are two cottage hospitals, established in each district capital in the area. Each hospital has 20–60 beds and a physician in charge who is concurrently in charge of the health centre.' (1954)[52]

The Singur health unit is 'a joint venture by the Governments of India and Bengal. It covers approximately 33 square miles with 62,736 population. The unit operates in two parts, each under the direction of a rural medical officer of health with four health assistants (with sanitary inspector's qualifications), three health visitors, three midwives, two dais, and two servants. The Singur headquarters, liberally staffed by the All-India Institute of Hygiene and Public Health, supervises the operation of the health unit and arranges for the training of health officers of all types.

'The primary objective, it is said, of the Singur health unit is to reduce readily controllable excess mortality and to build up a knowledge of vital statistics. The chief secondary objective is to build up a school health service. The work is governed by certain principles, e.g. (1) economic practicality, (2) interdependence of social services, particularly education, (3) the need to administer special functions by one administrative body, (4) the inevitability of compromise in short-term projects, (5) the need for scientific administration, and (6) the need for trained workers.

'Self-help provides much of the native force and is organized mainly through village health committees, co-ordinated by a "unit committee" under the secretaryship of the rural medical officer of health. The village committees cover a population of approximately 1,000. Each committee consists of five members elected by the village with a sanitary inspector as secretary. Each member of the village committee is responsible for the supervision of one of five routine health activities (vital statistics; epidemic control and smallpox vaccination; environmental sanitation; maternity and child welfare; malaria control). The scheme provides for the training of laymen in all villages to discharge their special functions, e.g. in the case of maternity, a young married woman, preferably the daughter of a practising dai.' (1945)[13]

Self-help with its great possibilities and limitations is being effectively practised throughout much of the developing world.*

HEALTH CENTRES

Health centres, which differ from a dispensary in having social and preventive functions (see pp. 150 and 154), were also now generally adopted, and in varying forms developed as fast as the training of staff permitted. Burma set out in 1941 to establish 800, using health assistants with 21 months' training; by 1957 she had 300 working. India implemented the Bhore report in this as well as in other

* For full details and references see *Self-Help – its Uses and Limitations in the Field of Health.* Central Council for Health Education, 1955, *ii,* No. 1, London.

respects; in the state of Bengal there were 106 primary health centres by 1950. Chile divided her territory into health zones which by 1958 contained 163 health centres. Leimena suggested five health centres in each of 12 new model areas in Indonesia[30] – each to have one public health nurse (co-ordinator), one midwife, one mantri for protective work, one hygiene educator, five assistant midwives, four assistant nurses, 10 village hygienists, and five home visitors. The social centres of Egypt[50] and the development projects in India[49] incorporated the health centre in a wider approach to community development.

BILATERAL AND INTERNATIONAL AID

The rapidity with which less favoured nations now began to 'develop', under the influence of international aid, was remarkable. As was said of Thailand in 1958:

> Thailand has developed fast, through the work of international organizations and with direct aid. Many nations have poured in money – the U.S.A., 100 million dollars since 1950. There are 325 projects in operation, from a $10 million scheme for providing hydro-electric power to the $30,000 education scheme for the teaching of English in Thai schools. WHO, UNICEF and UNESCO give aid, sending staff for training overseas and developing public health schemes parallel with, and sometimes overlapping, those of direct aid.
>
> Thus the nation is carried along on the crest of a wave of international aid. There are projects for abolishing malaria and yaws; villages are being persuaded to have privies; public health nurses go into the homes; and education becomes general. Hospitals, clinics, and all that goes to make scientific medicine, is growing rapidly. There is squalor, ignorance, and superstition; babies die; eastern diseases abound. But it is only now a question of time before Thailand becomes a developed land (1958).[7]

In this new setting many countries began to organize a permanent framework in which to develop the sanitary ideal. Model areas, experimental health centres, and special schemes under central direction pointed the way, but they did not give the final answer for public health practice. In particular everything pointed to the need for *a sound organization at the local level*, which could not only begin services, but maintain them. There are few short cuts to public health. Health programmes can be truly effective only with the understanding, support, and participation of the people. Weir, in his analysis of rural health problems in Egypt, interpreting the same philosophy, pointed to the needs among economically depressed and illiterate populations for autonomy of action at the village level, with village councils.[50] Even more important was the need for local authorities with legal backing. Public health needs the support of

the people, but it calls also for sanctions. In some of India's community projects, services begun with enthusiasm fell away, as other considerations arose. Thus it was said, 'the keeping of the wells clean was seen to be indifferently cared for' and 'the advent of the monsoon was marked by an outbreak of cholera'. When 'a small fee was proposed' for maintaining the spraying of D.D.T., few would have it.[27] These findings underlined the need, said the evaluation report (1954), 'for making statutory bodies responsible for maintaining such services'. Organization of public health in this sense in the under-developed world had hardly begun. Moreover the support of the citizens was little more than a faint stirring of interest; and the professional staff, who could put public health into practice, teach the people, and awaken their interest, was yet to come. All these must be long-term projects, which cannot be completed overnight. The surprising thing about the under-developed world was not that so much remained to be done; but rather the immense strides that had been made in so short a time.

Everything now depends upon the development in those countries of a 'permanent framework' of public health. For this we must look back to the European movement (Chapter 14) and its lessons. The permanent framework can come about *effectively* only as part of a National Health Plan, scientifically designed, economically sound and politically acceptable and accepted. (See p. 168.)

CHAPTER 17

A Permanent Framework of Public Health

It is not easy to find in the study of public health practice any set of principles which can be generally applicable in the establishment of a *permanent framework*. What works well in one country may fail in another. Unification or diversification, centralization or decentralization, state or voluntary agency, whole-time or part-time health officers, have all in different ways caught the imagination of able rulers.

The ideas about the administration and organization of public health, which have been growing in recent years, may not, and indeed cannot, be generally applicable in a world in which geography,

needs and customs vary so greatly; but they help in a critical analysis of existing services and in the establishment of new ones.

UNITY OF CONTROL

The first principle of good administration requires that when a special function is to be undertaken, it shall be undertaken by one governing body of the whole community needing the service. (British Ministry of Reconstruction, 1919)[23]

The wide spheres of influence in public health, not all directly related to medicine, make this an unattainable ideal. When health depends on industry, education, housing, insurance, town planning, water supplies, and other services which must have separate governing bodies, there will almost inevitably in any society be health services under 'other control'. Moreover when services operate, as is to be recommended, at three levels, central, provincial, and local, the measure of control will vary; and at the lowest level may not always cover the whole of what may be called strictly medical services. What does seem to be generally attainable is unity of control, at least at the centre, of all services which come within the immediate sphere of the doctor – hospitals, medical care by the practitioner, and public health. There is the danger, where one administration is responsible essentially for all the health services received by the people in any area, that 'preventive medicine often receives meagre attention' (WHO).

THE INSEPARABILITY OF PREVENTIVE AND CURATIVE MEDICINE

Preventive and curative medicine cannot be separated on any sound principle, and in any scheme of medical services must be brought together in close co-ordination. They must likewise be brought within the sphere of the general practitioner, whose activities should embrace the work of communal as well as individual medicine. (Dawson Report, 1920)[24]

This doctrine, examined earlier (p. 150), disposes of the argument that the inclusion of medical care in a public health scheme 'complicates administration unduly'. It applies, as we have seen elsewhere, in a special sense to hospitals – which should always be orientated towards public health (see Chapter 11). But the linking of curative and preventive medicine is most important in relation to general practitioners and the work of health centres; here medical care, based upon the family unit, will go hand-in-hand with health promotion,

prophylaxis, health education, rehabilitation, and that essential component 'the stimulation of local interest in public health'. The difficulties in the application of the doctrine are considerable. Excessive disease can swamp preventive work. This we have seen to be one explanation of the slow development of public health in colonial territories; it is a constant danger in the new health centres, particularly where hospital beds are provided, as in Turkey.[5 12] Moreover it depends much on the training of doctors, and the teaching of the preventive and social aspects of medicine, which, as so many have emphasized, is still deficient throughout the world. John Grant agreed with the Goodenough report that the first step in the demonstration of progress in new forms of medical service is its establishment by the teaching hospitals.[23]

CO-ORDINATION

Developments in public health make it essential to co-ordinate all measures of prevention, care, and restoration under one system of health service. (WHO, 1952)[52]

Although it is not clear what is meant by 'one system', which in any event, like unity of control, may be unattainable, it is certain that careful attention needs to be given to the way in which different parts of the service, and of allied services, work together. Lack of co-ordination in central and local departments, inadequate working arrangements between hospitals, general practitioners, and public health, disjointed efforts by voluntary bodies, are everywhere limiting factors. It is not unknown for one organization to be undoing the work of another. There are many answers to this particular world-wide problem, but none is a sovereign remedy. Perhaps the most effective is the well-trained health officer, operating at central, provincial, and local levels, who can work effectively in the field of human relations. Some part of the answer lies in a clearer definition of functions as between authorities and at different levels.[52]

PRIMACY OF PREVENTIVE MEDICINE

The primacy of preventive medicine is to be maintained by having health-minded rather than disease-minded persons responsible for overall planning and the direction and allocation of community services. (John Grant, 1947)[23]

This principle has generally been accepted, so far as it concerns administrators at the central level. Where the hospital is included in

the administration at the periphery it offers the best opportunity of preventing hospitals from becoming autonomous, with uncontrolled vested interests in curative medicine. It is the health officer rather than the hospital officer who should plan.

LOCAL GOVERNMENT

The health of the nation is based on the competent performance of established health functions at the local level of government, where local initiative, responsibility, and resources are involved by the power of local public opinion. (Haven Emerson, 1948)[15]

This principle is probably universal in its application, if somewhat variable in its interpretation. Local government elected by public franchise, as in England, which spends monies collected by a local rating system, is unlikely to be of general application. An electoral system may increase the tie of responsibility between the member on the council and the local citizens; but many health boards, as in America and under the National Health Service in Britain, which are *selected*, are able to function with initiative and responsibility. Nor is absolute autonomy necessary; so that health functions can be discharged at the local level with all the qualities that Haven Emerson asks for, within a system of central power.

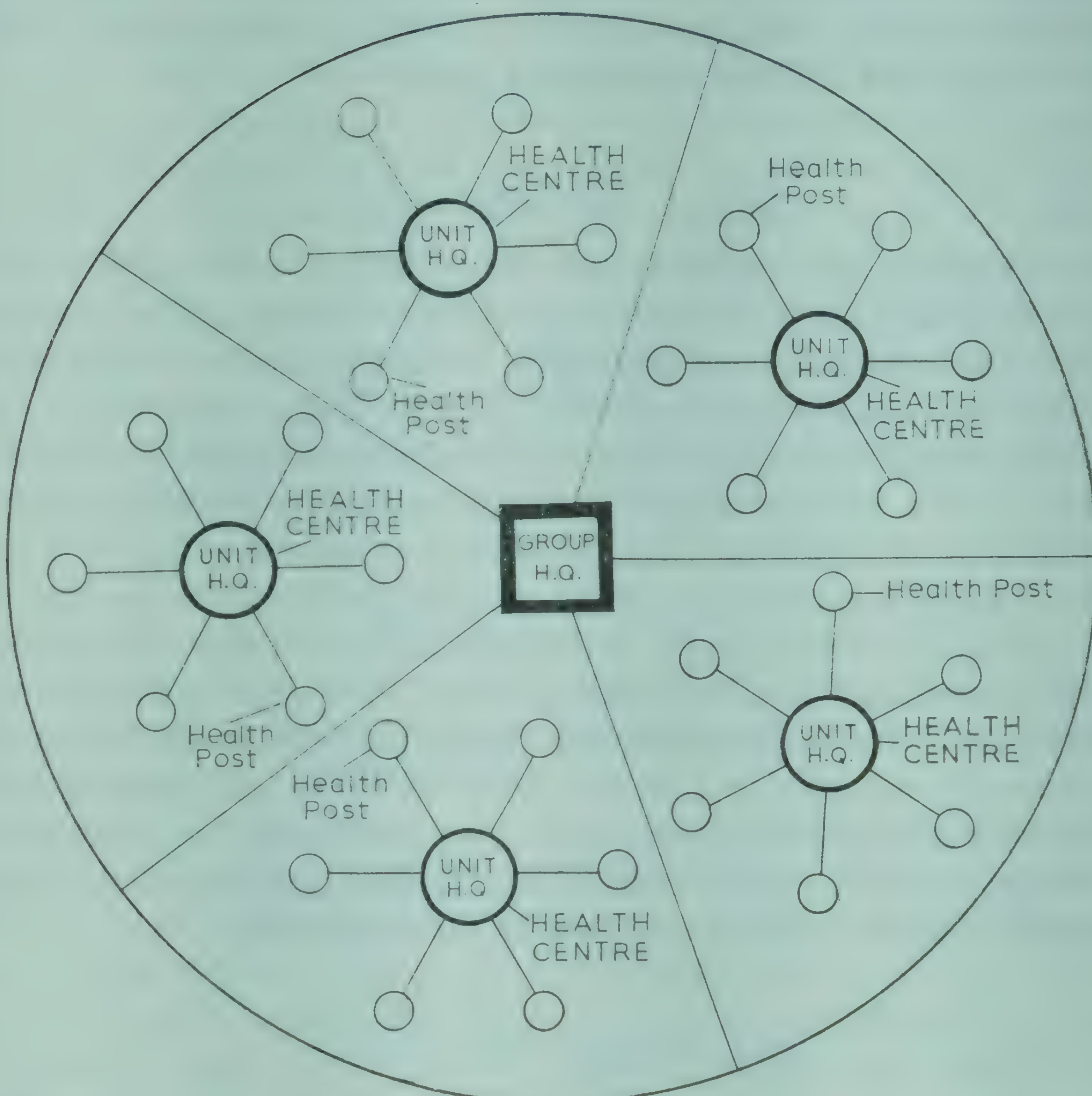
THE INFRASTRUCTURE

The health infrastructure is that organized network of peripheral units capable of providing certain basic health services . . . to cater for the most urgent needs of the population. (WHO Expert Committee on Malaria, 9th report)

The infrastructure is the most peripheral viable organ of administration in a health service. It is designed to undertake day-to-day activities in any field, curative or preventive, under the direction, with varying degrees of autonomy, of higher policy-making bodies. It consists of *groups* of *local health units* (as in diagram) each group covering say 250,000 people; 4 groups can conveniently constitute a *district* of about 1 million; and 5 districts a *region* of about 5 million.

The infrastructure of health is thus woven like a fabric throughout the nation. It is knit together into a wider framework of public health administration; but with freedom of manoeuvre at the local level. Each *local health unit* within a group (perhaps 50 to 100 thousand people), whether urban or rural, should provide the basic health services for the area. These small operative units can best coincide

HEALTH INFRASTRUCTURE
PERIPHERAL UNIT



APPROX. POPULATION 250,000

with the boundaries of local government in other matters. Equipped with doctors, nurses, midwives, sanitarians, social workers and auxiliaries, they can deal with maternity and child welfare, school health, sanitation, industrial health, the control of infection and animal-borne disease, health education, vital statistics and medical care at the community level. For much of its motive force – as for planning, technical advice, finance, trained personnel, hospitals, laboratory services, special services for disease eradication and research – the unit depends upon intermediate and higher levels of government, i.e., districts and regions.

The infrastructure is concerned mainly with conditions which do not require hospital care; their relationship is directly with home and family; they give *continuing* medical and nursing care for adults and children at home or in a centre. There is care in childbirth by professional midwives; and where these are not available by village

women with in-service training. The confidence and respect engendered by high-level clinical care provides the background to an active programme of health education. Sanitary supervision is based upon the science of environmental hygiene and linked with health education. Tuberculosis, malaria, trachoma, yaws, leprosy, smallpox and all other subjects of mass campaigns, when handed over, are based on detection, surveillance, supervision, contact tracing, vaccination, immunisation and home treatment. Social factors in the home, at work, school and elsewhere in the environment are a first consideration. The controlled collection of vital and health statistics provides objective and valid data for planning the services. Nowhere is the need for an infrastructure better illustrated than in the diseases due to faulty sanitation; in some areas, 50 per cent of prevalent disease is due to this alone. Pure water supplies, proper sewage disposal, housing, the avoidance of food contamination are seen, perhaps a little belatedly in view of the experience of the developed world, as overriding considerations. For most of the problems of faulty sanitation the answer is to be found locally in painstaking attention to detail. To achieve benefits in this field of preventive work sound public health units are essential.

The infrastructure of health is directed by a general medical epidemiologist, a physician with post-graduate training in epidemiology, sociology and administration; as an expert in the prevention and cure of disease and the promotion of health at the community level, he is in charge of all the services for health in the area with the overall duty 'to acquire an accurate knowledge of the influences – social, environmental, industrial – which may operate prejudicially to the health of his area; he is variously styled a director of health, a health officer or a medical officer of health. A minimum establishment for an effective service is one health officer for a *district*, i.e., one million population. In countries with sufficient physicians there should be one health officer for a *group* of health units, i.e., 250,000 and where possible one for each *local health unit*, i.e., 50 – 100,000. In countries where health officers cannot be appointed below one million population, supervisory non-medical staff, with special training in epidemiology, will be needed.

Five levels of infrastructure can be distinguished in different parts of the world:

Grade 0 – Little or nothing in the form of service below the level of central ministry or region (e.g., Liberia or Mauritania).

Grade 1 – A rudimentary network of treatment points or dispensaries, without social or preventive functions; these are generally

linked to a distant district hospital. Epidemiological cover is lacking and supervision is by hospital clinicians without post-graduate training in public health (e.g., Togoland).

Grade 2 – A system of 'health posts' or 'district sub-centres', grouped under a part-time health officer at the district level. The health officer is usually engaged in private medical practice and the health posts are manned by auxiliaries with the possible addition of a midwife (e.g., Burma).

Grade 3 – A system similar to the above, but with a whole-time health officer at the level of the district and with 'health centres' covering 1–3 hundred thousand population. The 'health centres' contain auxiliaries, para-medical workers, nurses and general medical practitioners; they have a number of 'health posts' or 'district sub-centres', say 10–15, dependent upon them for supervision (e.g., India).

Grade 4 – A system of whole-time health officers at the level of the *group* (250,000) or the *local health unit* (50–100,000) with a full complement of general medical practitioners, health visitors, midwives, social workers, etc. Health centres and district sub-centres may or may not exist in the developed countries (e.g., United Kingdom).

Health centres differ fundamentally from a dispensary in having social and preventive functions (see p. 158). District sub-centres or health posts are smaller versions usually staffed by auxiliaries, with little or no professional cover from physicians, nurses or midwives.

A minimum infrastructure for general public health should lie somewhere between grades 3 and 4; each *group* having at least 1 health centre with a general medical practitioner and a staff of public health nurses, midwives and para-medical workers.[54 55 56] The district sub-centres can be staffed by auxiliaries, if adequately supervised from the health centre. An auxiliary has been defined as: a paid health worker with less than a full professional qualification in a particular field who assists and is supervised by a professional worker (WHO/WPRO).[59]

An infrastructure should be given high priority in all planning. It should come before hospitals or at least in parallel with them. Britain in the last century, when the health picture was little better than that of the under-developed world today, did not build hospitals, except as a by-product of charitable activity. It built drains and set up public health departments, under the lash of Chadwick's whip. The under-developed world, harassed by sickness, may rush too easily to hospital construction. Hospitals will not eradicate

infestations with worms, which lower the stamina of millions, will not stem the onset of kwashiorkor with its frightening hazards for child life, nor will they prevent the plague of rickets throughout the sun-drenched lands of the Middle East. It requires great wisdom to follow the lead of Professor Stampar in establishing *institutes of hygiene* and *health centres* as he did throughout the republic of Croatia. But those who do reap a rich reward.

An infrastructure is one of the most effective means of getting the participation of the people, without which, as so many authorities have said, no lasting advances in public health can be made. It brings public health problems down to the people. By continuous oversight and interest, the health officer and his staff not only build up protective measures, but also ensure that they are maintained against adverse influences – some of which have been seen at work in the community projects of India. Health units can also involve the people in health, and arouse their lasting interest, through village committees; by the training of villagers for simple tasks; and by self-help schemes.

If health measures cannot achieve any real value unless the people themselves understand them – as, with limitations, is now generally accepted – then the planning of services in small workable areas will help in the essential programme of health education, worked out in detail in accordance with the needs of the area. Moreover they provide the atmosphere in which to build up understanding and sympathy for folklore and customs, without which, likewise, little real progress is possible. *Health cannot be imposed upon a people; it must be won in partnership with them.*

Participation by the people, possibly the most successful component of the health services which followed the Chadwick pattern, is certainly an indispensable element in public health everywhere. It may be won by the electoral system of local government as in England, by the strong social activities of both the public and the doctors as in Scandinavia, by the soviets of Russia, the voluntary councils and committees of America, by village committees in India and elsewhere, and no doubt in a variety of other ways; by whatever means it is achieved it must be suited to the philosophy of the country.

Voluntary effort has been shown universally to be an indispensable element in the development of health services. (The functions of the health infrastructure are well described in 'Basic Health Services', a joint UNICEF/WHO document (1965).[47a])

HEALTH PLANNING

'Governments in developing countries are becoming increasingly aware of the advantages of health planning at a national level and are therefore anxious to utilise for this purpose techniques that take into account specific problems of their country.' (WHO Expert Committee on National Health Planning in Developing Countries. Techn. Rep. Ser. 1967, No. 350.)

The first and immediate need is for a *health plan* within the Ministry of Health itself. The range of possible developments in the health field is so great while resources are so limited, that developing countries find themselves in constant danger of muddle and frustration resulting from unplanned activities. Confusion repercusses throughout the services; for those away from the national controls, working in hospital or in the field, with little if any power to guide events, it is frustrating to witness plans go awry, services halting and monies spent overgenerously here and niggardly there. The health plan should ensure:–

(1) that a balance is struck between curative and preventive medicine. This alone will make possible the development of a health infrastructure (see p. 163). It will also help to ensure a balance between care for in-patients and other services.

(2) that the priority of certain diseases, age groups and occupational groups be decided upon and used as a firm guide to action.

(3) that the most economical instruments (staff and materials) be chosen to meet the objectives.

There then arises a wider issue; for health planning must 'form part of a rational organization and deployment of national resources'.[58] It should become 'an integral part of economic and social development'. Only in this way can the health plan be realized against the background of the realities of national development. Thus, e.g., the educational services of the country can work in harmony with the health services, designing courses and recruiting students in higher education in terms of the immediate priorities and practical possibilities of the health plan.

The National Health Plan calls for a central planning authority to assess the problems; to formulate a co-ordinated scheme; to obtain acceptance by political heads; to implement and periodically evaluate the plan.

The processes of planning and subsequently administering health plans calls for special training in epidemiology, sociology and administration which should be given at a postgraduate level to physicians, preferably as part of courses in public health.[57]

PART FIVE

INTERNATIONAL PUBLIC HEALTH

CHAPTER 18

From Quarantine to World Health

THE QUARANTINE PERIOD

THE origins of international collaboration in public health, as in those of national public health, are to be found in the fear of epidemic spread. The possibility of contagion was recognized by many even during the centuries when diseases were little differentiated; when fevers were attributed to exhalations from the ground, or to putrefying odours, or to the state of the atmosphere; when millions believed that sickness was a punishment from the gods. The Court left sixteenth-century London so soon as the Bills of Mortality gave warning; Boccaccio's young aristocrats fled to the country from plague-stricken Florence[13]; in times of pest people in Constantinople hurried along the side-walks fearing the touch of another.[12] The people of the little village of Eyam in Derbyshire, England, to which the plague was brought in 1665 in a box of old clothes, isolated themselves and died, nearly to a man, in putting this belief into practice.[13] There have been examples of the 'cordon sanitaire' from A.D. 630, when armed guards were placed on the roads leading from Provence to Cahors, to A.D. 1720, when Marseilles was ringed with sentries. The movements of armies, of traders, and of pilgrims along the golden road to Samarkand, and by other land routes, and of ships along the Black Sea, the Mediterranean Sea, and the Persian Gulf have been known to carry disease from the East to Europe for upwards of a thousand years. Europe has reciprocated. Traders and adventurers from the West have carried infections, as well as colonies and commerce, to most hemispheres.

Each nation thought only of itself. The obvious practical answer was quarantine – a remedy which was operated at least from the fourteenth century, when Venice first set up a sanitary council of three noblemen (1348).[13] The first lazaretto was established in the following century (1423). After 1585, when Britain first attempted

quarantine, every European country, and most seaports, adopted its own regulations.

The value of quarantine, in days when modes of transmission were unknown, can never have been great. Rats infected with plague, with the fleas which carry infection to man, will often have run along the ships' hawsers to the dockside; and passengers in the lazarettos with few symptoms, but heavily infected with the vibrio of cholera, will have gone ashore to contaminate water supplies and food. But the appearances of protection were not wanting – since epidemic spread depends on many variables and is almost unpredictable. In 1720 when plague spread from Africa to Marseilles it failed to cross the English Channel; who was to say that this was not due to the quarantining of all ships which Richard Mead, physician to St Thomas' Hospital, London, had again recommended in his *Discourse on the Plague* (1720)?[16] Much of public health has had its beginnings in equally empirical action.

It would be pleasant to record that international collaboration in public health began with the need to discuss the eradication of smallpox, following the publication of Jenner's discovery in 1798 of the preventive qualities of vaccination with cowpox; or, indeed, at any time during the previous century when inoculation from arm to arm had been in vogue. It might equally have had its origins in a determination to abolish scurvy from the world, following James Lind's demonstration of the virtues of fresh oranges and lemons on board H.M.S. *Salisbury* in 1747.[15] Smallpox and scurvy shortened life and brought untold misery to millions. They were the first two diseases for which scientific proof of prevention was obtained; their elimination had immense possibilities for human happiness; they were an admirable subject for concerted international action. Much too was known about the means to combat malaria, which even in 1857 may have been the cause of a million deaths yearly; enough at least to have made international discussion valuable.[18]

At the beginning of the twentieth century there were extensive anti-malarial drainage projects in many places, as widely separated as New York and Sierra Leone, Brazil and Hong Kong. Soon after 1820, the alkaloid quinine replaced cinchona bark, used in prophylaxis at least since Lind recommended infusions and tinctures for this purpose.[18] But the time was not ripe for international public health in this sense. Perhaps there was so much sickness in the world that a little more or less made no difference.

It was the subject of quarantine which brought nations together in the first international meeting in 1851. From the outset quarantine

had had great inconveniences, particularly to sea-going nations. When rigorously imposed it could be brutal – defaulting sailors were treated as felons and might suffer death. Ships had not infrequently been burned as Mead had advocated; or they might be marooned, like the *Matteo Bruzzo* in 1884, unable to land for four months on either side of the Atlantic.[9 19] At its least the continual waste of time for passengers and crew alike was profoundly irritating. More generally, on payment of adequate consideration, it was honoured in the breach. But whether applied or misapplied, the damage to trade was considerable. And so it came about that this mundane consideration of how to protect trade – and not humane feeling about how to prevent disease – was the main item on the first international public health agenda.

INTERNATIONAL CONFERENCES 1851–1909

Quarantine, and the origins of infection, provided the main topic not only for the 1851 congress in Paris, but also for the nine further international meetings – Paris 1859, Constantinople 1866, Vienna 1874, Washington 1881, Rome 1885, Venice 1892, Dresden 1893, Paris 1894, and Vienna 1897 – which took place before the turn of the century.[13] * Interest was heightened after 1869 when the Suez Canal was opened.

Nothing came out of these meetings, except the fact of having met. The two diseases that could be prevented were not discussed. Other diseases were discussed at length without any of the scientific evidence which alone could have made such deliberations of value. That fleas carried plague was not certainly known until 1905;† the role of the mosquito in yellow fever not before 1900–02 and that of the louse in typhus fever not before 1909. Even the diseases themselves were confused. At the 1851 congress many of the delegates confused plague with typhus. Typhus fever had in any event been distinguished from typhoid fever by William Jenner only two years previously (1849). The main topic of all these discussions was the

* There were also a number of international statistical congresses devoted to the use of uniform classification of causes of death. The first was held in Brussels in 1853. It was followed by further congresses at Paris in 1855, 1864, 1874, 1880, 1886; at Vienna 1891, Chicago 1893, Christiana (Oslo) 1899. During this century international conferences with the particular purpose of revising the international classification of causes of death have been held roughly every ten years from 1900.

† The transmission of plague by fleas was first suggested by Ogata in 1897, Simond (1898), and Gautier and Raybaud (1903), but the flea theory was specifically developed by W. G. Liston (1905).

nature of infection, with the contagionists ranged against the miasmatists. As the nineteenth century passed scientific epidemiology was born; but slowly. John Snow* had given the first scientific proof of the transmission of cholera by faecal contamination of water supplies in his Soho study (1854), first suggested in a 'slender pamphlet' in 1849. Now that the world is drowned in words, it does good to contemplate so much benefit to mankind from so few. The work of Pasteur (1822–95) had its culmination in preventive inoculation against hydrophobia in 1885.

The discovery of the tubercle bacillus in 1882, and two years later the vibrio of cholera and the bacilli of diphtheria and typhoid, literally ushered in a new era. The specific organisms of many of the great problems of public health were discovered at short intervals with almost bewildering speed up to the turn of the century: pneumonia (1886), brucellosis and cerebro-spinal fever (1887), the fungus of actinomycosis (1891), the bacillus of plague (1894), dysentery (1898); the spirochaete of syphilis waited until 1905. None of this work seemed immediately to affect discussions at the international level. As in most meetings – international, national, or local – there was special pleading. The British delegation in 1851 – influenced no doubt by considerations of trade – denied that cholera was contagious; epidemic constitutions, as Sydenham had postulated, or perhaps the odours, they said, of putrefying matter, as the Greeks had thought, was the cause of outbreaks of pestilence. Yet, the medical member of this same British delegation, Dr John Sutherland, had his office in the General Board of Health at Gwdyr House, Whitehall, in Westminster, only 850 yards from Soho, north of Piccadilly, where John Snow had made his revolutionary observations on the transmission of cholera. But it is always hard for administrations to accept new teachings. The fact that it took up to fifty years for the medical colleagues of John Snow to accept and act upon his teaching may be a pointer for those who find action upon modern epidemiological discoveries too slow to follow.

L'OFFICE INTERNATIONALE D'HYGIENE PUBLIQUE

The idea of a permanent international organization gradually emerged. It was first suggested in the fourth congress of 1874, and finally accepted in the eleventh at Paris, 1903. The year previously a Pan-American Sanitary Bureau (1902) had been formed with

* *On the Mode of Communication of Cholera,* 1849. In the second edition (1855) John Snow said, 'The first edition of this work, which was published in August 1849, was only a slender pamphlet.'[21]

headquarters at Washington. L'Office Internationale d'Hygiène Publique, popularly known as the Paris Office, came into being in 1909[13] with the following terms of reference:

> To collect and bring to the knowledge of the participating states the facts and documents of a general character which relate to public health and especially as regards infectious diseases, notably cholera, plague, and yellow fever, as well as the measures to combat these diseases.

The Paris Office, directed by a committee consisting of one technical representative of each participating state, had a small permanent whole-time staff, consisting of a director, a secretary-general, two or three technical assistants, a librarian, and an accountant.

It was concerned mainly with quarantinable diseases – to gather information, to revise conventions, and to arbitrate on differences. Speaking generally, international public health during the first seventy-five years of international collaboration up to the end of the First World War was restricted to epidemic intelligence, and this in a limited form; mainly how to stop the major diseases from spreading to the developed countries. The possibility of fighting disease on a broad front everywhere had hardly yet been considered. The concern for health as a state of mental, physical, and social well-being, and the right of every man, was even more remote.

But it would be an injustice to the Paris Office to omit to mention the genesis of a wider view. The office began to widen out the range of subjects for international regulation. Most notably, it obtained agreement by fourteen countries for certain measures against the spread of venereal diseases along the shipping routes. A campaign was then begun that is not yet brought to a successful conclusion. It also began the standardization of sera and the control of the drug traffic. Within its own committees, it began to discuss other public health problems – ranging from anthrax in shaving brushes to the organization of hospitals. These may be regarded as the forerunners of the 'expert committees' of WHO which have done so much to spread an understanding of the scientific approach to public health.

THE HEALTH ORGANIZATION OF THE LEAGUE OF NATIONS

In 1923, the Geneva Office, the health organization of the League of Nations, was created, and this functioned until the Second World War alongside the Paris Office. It had the following terms of reference under the Covenant of the League of Nations, article 23(*f*),

to 'endeavour to take steps in matters of international concern for the prevention and control of disease.'

Within this wider framework, international public health began to advance. The Geneva Office produced a system of epidemic intelligence of greater efficiency, with a peripheral centre at Singapore (1925). Thus it recognized that the great epidemic diseases, which are occasional trespassers in Europe and the New World, are a perpetual menace to the vast regions of the East from Vladivostok to Australia and from Mombasa to Hawaii. In its weekly epidemiological record it covered not only the five 'convention' diseases – plague, cholera, yellow fever, smallpox, and typhus – but also many others, such as poliomyelitis, enteric fever, scarlet fever, and dysentery.

The Geneva Office also carried on the work of international standardization and the control of the drug traffic begun by the Paris Office. It gave particular attention to codes of vital statistics.

Much the most effective part of its work was, however, done by means of *expert committees* – then called technical commissions – of which, in the field of international public health, it must be considered as the inventor. International committees of experts met in Geneva and elsewhere to consider malaria, cancer, nutrition, housing, health centres, syphilis, tuberculosis, rheumatism, heart diseases, the teaching of medicine, and other subjects. Many of these had far-reaching results. The commission on nutrition (1936), for example, laid down a standard minimum diet which made it possible to examine, by means of dietary surveys, the state of nutrition throughout the world.[14]

Of equal importance was the *International Conference* which the Geneva Office also developed. A European Conference (1931),[8] and a Far-Eastern Conference (1937),[11] produced well-documented statements about public health needs in under-developed countries. These remain as classics to this day. African conferences were held at Cape Town (1932) and Johannesburg (1935). The Geneva Office began the system of organizing tours and exchanges for study abroad.

No doubt to many, including those who framed the terms of reference for the Geneva Office, it was a disappointment that more practical steps were not taken to help with public health in the field. Unfortunately the total maximum budget of £78,500 was too slender for such ventures. Practical assistance was, in fact, given in combating epidemics of typhus fever with which the war had ended in Poland, Russia, Rumania, and Greece; and aid was also given in

establishing permanent health services in Greece and China. Courses of instruction in malaria control were organized in S.E. Asia. But, after this, money and staff were not forthcoming. The work of 'practical aid' in the field had to await another war and the creation of an international organization with a more generous budget. Until then such efforts remained with voluntary agencies, among which the Rockefeller Foundation is outstanding.

World War II greatly interfered with the work of the Paris and Geneva Offices. To all intents they came to an end. In 1944 UNRRA (United Nations Relief and Rehabilitation Administration) was created to help the devastated world; and for somewhat over two years it acted as an international health organization. It had a staff of 1,134 persons, including nationals from thirty-five countries, and it spent over £58 million. But it was no more than a stopgap in the interval before a new world-wide organization could be erected.

CHAPTER 19

The World Health Organization

THE INTERIM COMMISSION 1946–8

THE Charter of the United Nations, signed at San Francisco in 1945, inserted the word 'health' on the proposal of the delegate from Brazil. The delegations of Brazil and China then recommended that a general conference be convened within the next few months for the purpose of establishing an international health organization. As it was minuted:

> They intend to consult further with the representatives of other Delegations with a view to the early convening of such a General Conference to which each of the Governments here represented will be invited to send representatives.
>
> They recommend that, in the preparation of a plan for the international health organization, full consideration should be given to the relationship of such an organization and methods of associating it with other institutions, national as well as international, which already exist or which may hereafter be established in the field of health.
>
> We recommend that the proposed international health organization be brought into relationship with the Economic and Social Council.

Although the Governments of Brazil and China followed up the Declaration by suggesting that a Conference be held before the end

of 1945, the resolution relating to this proposal was adopted by the Economic and Social Council only on 15 February 1946. In accordance with the terms of para. 3 of the Resolution, the Economic and Social Council established the Technical Preparatory Committee and directed that it should meet in Paris not later than 15 March 1946 to prepare a draft annotated agenda and proposals for the consideration of the Conference, to be held not later than 20 June 1946.[17] The technical preparatory committee sat under the chairmanship of Dr René Sand. The international conference of fifty-one nations, which was held in New York, adopted the draft constitution drawn up by the preparatory committee with few changes of substance. It also established an interim commission of eighteen states to bridge the gap until the constitution of a world health organization could be ratified. This was not brought about until 7 April 1948, when the necessary twenty-six states had formally assented. Thus, the interim commission, first under the chairmanship of a Russian, Dr Krothov,* and then of a Yugoslav, Professor Stampar, remained in being for over two years.

These two years of delay were not wasted. The Interim Commission dealt successfully with great emergencies, such as the Egyptian cholera outbreak, and with the day-to-day international health work which it inherited from the Paris office and the League office. But more than this, it had two years in which to plan; two years in which to use the exceptional genius of Andrija Stampar, who twenty years before had started his Institutes of Hygiene and health centres in the new Yugoslavia, with social medicine incorporated in the work of the Zagreb School of Public Health. Much that has followed may be due to this happy chance.

CONSTITUTION OF WHO

The first World Health Assembly, which met at Geneva in June and July of 1948, was attended by fifty-two out of fifty-four eligible states, only Afghanistan and Jordan being absent. The new body, which began work in September 1948, absorbed, in addition to UNRRA, both the Paris and Geneva Offices. WHO thus became the sole international health organization, excepting the Pan-American Sanitary Bureau, which continued independently, but worked in close association with it and became, in 1949, the regional office for the Americas. A severe and unexpected blow, after the favourable opening address of the Russian delegate, Dr N. A. Vinogradov, was the virtual withdrawal in 1949 of Russia, and,

* Dr Krothov remained in office only two days.

during the next eighteen months, one by one, of all the other eight Cominform countries, from active participation in the work of the organization. The reasons given were inefficiency and poor administrative machinery. Since the charter contains no provision for any resignation, these states continued on the roster of WHO membership, but were designated as 'inactive'. In 1956 Russia again expressed a wish to take an active part in the work of WHO and in 1957 with some of the other countries of Eastern Europe, she returned to full participation. In 1967 the membership was 125 full members and three associates. Thus it covers a wider area of the globe than the UN itself; very few states are now outside the organization, including E. Germany, N. Korea, N. Vietnam, and, most important, mainland China.

The World Health Organization operates as one of the organizations active in the economic and social sphere known as specialized agencies of the United Nations.[22] By a specialized agency is meant one which conducts a programme of importance to the United Nations, in a special field of competence, under the general review of the General Assembly and the Economic and Social Council, but with important scope of autonomy in matters of membership, programme, personnel, and finances.[1] It has an office in New York to maintain liaison with the United Nations and other agencies. The headquarters is located in Geneva, where the Assembly, the parliament of the organization, usually meets. Between the annual meetings of the Assembly the work of the organization is directed by an executive board acting as a cabinet. This is non-political, and consists of 24 persons, designated by 24 nations elected for the purpose by the Assembly. Eight members retire and are replaced each year. The Director-General of the organization has a whole-time staff of about 4,000 persons,* recruited in rough proportions from the constituent nations. These are divided in approximately equal parts between the Geneva headquarters, regional offices, and field work. The staff is predominantly medical. The work of the Geneva headquarters is administered through fifteen divisions: Public Information; Education and Training; Health Protection and Promotion; Public Health Services; Biomedical Sciences; Communicable Diseases; Research in Epidemiology and Communications Science; Co-ordination and Evaluation; Malaria Eradication;

* On 30 June 1957, 1,413, including 461 provided by Technical Assistance. The figure included 262 doctors, 171 nurses, 44 sanitarians, 158 other medical and para-medical staff; the 1967 budget provided for a total staff of 4,346 (1,451 being provided by Technical Assistance and 110 by the Voluntary Fund for Health Promotion).

Pharmacology and Toxicology; Administrative Management and Personnel; Budget and Finance; Editorial and Reference Services; Environmental Health; Health Statistics.

The World Health Organization is independent; and its decisions, unlike those of the health organization of the League of Nations, do not need to be endorsed by a higher body. Its constitution is wide enough to permit it to undertake any health work within the limits of its budget. The ceiling of expenditure, first fixed at 5 million dollars, was raised to 13·5 million dollars (1958) and to 53 million dollars (1967). Payment by member states is based on the United Nations scale. The U.S.A. pays about one-third,* the U.K. about one sixteenth. WHO also benefits substantially from the UN Development Programme, which aims to help low-income countries to create conditions in which capital investment is both feasible and effective. UNDP, created in 1965 by the General Assembly of UN, is a consolidation of earlier machinery for economic aid, namely, *technical assistance* and the *special development fund*. It functions under the Economic and Social Council, with its policy controlled by a thirty-seven member governing council, through eighty-two field offices. In 1957, WHO received 5·8 million dollars from technical assistance; in 1966 it received 9 million dollars from technical assistance and 1¼ million from the special fund. The technical assistance component of WHO's total expenditure is declining; for field projects it was 52 per cent in 1957 and is estimated to be only 17 per cent in 1968. There is also money from the Voluntary Fund for Health Promotion (2·3 million dollars in 1966); this was established in 1960 to receive monies from public and private sources to be used in activities over and above the regular budget. It gives flexibility, as illustrated by the community water supply programme (1959) which has spent about a million dollars to meet urgent requests in various parts of the world. International health projects also benefit from equipment and supplies made available by UNICEF. Each national government also bears a large share of the cost of health projects which it undertakes with international assistance; expenditure by governments in 1967 amounted to 353,586,190 dollars.

TERMS OF REFERENCE

The World Health Organization has grown out of the past. But its terms of reference are much wider.

* The Fourth World Health Assembly decided that the U.S.A. contribution should be reduced to a maximum of one-third of the total budget within four years.

The first article in the Charter of the World Health Organization gives as its objective, 'The attainment by all peoples of the highest possible level of health'. This, says the introduction in a clarion call, is to be regarded as 'one of the fundamental rights of every human being, without distinction of race, religion, political belief, economic or social condition'. 'Governments', it adds, 'have a responsibility for the health of their peoples which can be fulfilled only by the provision of adequate health and social measures'.

The Charter is thus remarkable for its breadth of vision. The aim is health – 'a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity'. This implies public health on the highest plane – to promote health, to prevent disease, and to rehabilitate suffering. Public health in the nineteenth-century sense of overcoming infectious agents of deadly diseases is to be widened to encompass practical social medicine. The twentieth-century public health is concerned with social factors before, during, and after the onset of illness – all disease, degenerative as well as infectious, mental, and physical. It is keenly interested in handicaps and other biological infirmities, which cannot be avoided; it believes in education about what we know and do not know in health matters; and it wants accurate records of morbidity and mortality and allied social phenomena. The specific inclusion in the Constitution of responsibility in the fields of mental hygiene, nutrition, and medical care, are illustrations of this modern concept of public health.

The scope of activities laid down for WHO by its Constitution goes far beyond the work done by previous organizations.[6] The following nine powers, among twenty-eight major provisions, give an idea of its scope:

(a) To assist governments, upon request, in strengthening health services.

(b) To promote improved standards of teaching and training in the health, medical, and related professions.

(c) To provide information, counsel, and assistance in the field of health.

(d) To promote, in co-operation with other specialized agencies when necessary, the improvement of nutrition, housing, sanitation, recreation, economic and working conditions, and other aspects of environmental hygiene.

(e) To promote co-operation among scientific and professional groups which contribute to the advancement of health.

(f) To promote maternal and child health and welfare and to foster the ability to live harmoniously in a changing total environment.

(g) To foster activities in the field of mental health, especially those affecting the harmony of human relations.

(h) To promote and co-ordinate research in the field of health.

(i) To study and report, in co-operation with other specialized agencies where necessary, on administrative and social techniques affecting public health and maternal care from preventive and curative points of view, including hospital services and social security.

The constitution of the World Health Organization takes in the whole of mankind. In this respect also the Organization differs from any of its predecessors by its world-wide character, by the absence of discrimination between races, and, perhaps most of all, by the shift of emphasis towards under-developed countries. WHO in fact takes up the challenge which the remarkable variations in the health picture throughout the world throws down (see Chapter 4). The developed world, with almost a century of industrialization, has overcome the major infectious diseases; infant and child mortality have fallen to a small fraction of the losses of last century. Life has lengthened out so that half the people live now beyond seventy years of age, four out of five dying of degenerative disease, mainly of the circulatory system. In contrast, as we have seen, the under-developed world still dies young; it has a high infant and child mortality; it suffers immense loss of life, and still greater illness from many infectious diseases. Degenerative disease, which people do not live long enough to experience, is much less common. What one part of the world gained, should not be impossible for another.

Yet, although WHO may lean towards the under-developed countries, it has a responsibility also to those countries where public health began. The problems of degenerative disease, of mental illness, of the viruses and of social disorders, which these present are, in their way and at a different level, as pressing as those in the under-developed world.

REGIONAL OFFICES

The extreme variety of problems throughout the world, the immediate urgency of need in the under-developed countries, and the fact that local international organization already to some extent existed, made regionalization inevitable. Thus regional organizations

were the subject of special provisions in the Constitution (Chapter 11), including the following:

(1) The Health Assembly is required to define the geographical areas in which it is considered desirable to establish a regional organization. (2) With the consent of the majority of member states situated within each such area, the Health Assembly may establish a regional organization to meet the special needs of such area. (3) Each regional organization is an integral part of the world organization. (4) The regional organization consists of a regional committee and a regional office. (5) Regional committees are composed of representatives of member states in the region.

This left much to be decided as to the measure of autonomy which the regional offices should have. Some areas favoured regional services without immediately implementing the provisions of the Constitution, on the argument that nobody is expected to produce a family before the age of maturity. The existence and pressure of the Pan-American Sanitary Bureau helped to determine the course of events. In the result, WHO is alone among the specialized agencies to have adopted a policy of full regionalization.

The six regional offices, under the direction of regional committees composed of member states and associates, came into operation at different times. The first to be approved by the Executive Board was that for South-East Asia (New Delhi) in 1948; in 1949 there followed the Eastern Mediterranean (Alexandria), and the Americas (Washington) by agreement with the Pan-American Sanitary Organization to use the existing Pan-American Sanitary Bureau; finally in 1951 the Western Pacific (Manila) and Africa (Geneva); in 1952 Europe (Geneva). The irregular timing depended on many factors. Agreements of the countries involved took time; New Zealand and Australia, for example, for long opposed the Western Pacific office. The location of the regional office was not easily determined. Africa and Europe, first located in Geneva, moved respectively to Brazzaville (1952) and Copenhagen (1957).

Further decentralization with a measure of autonomy has been carried out by the Regional Office for the Americas. The American continent has been zoned with subsidiary headquarters at Washington, Mexico City, Guatemala City, Lima, Rio de Janeiro, Buenos Aires.

The regional committees have wide powers, including that of formulating policies and of calling conferences. They co-operate with other regional groups having common interests; they may nominate the Regional Director for appointment by the Executive Board. The regional offices have considerable autonomy. They are responsible for drawing up, in collaboration with governments and

within the allotted budget, a plan of international assistance for health projects. After approval and allotment of funds by the Assembly, the regional office is again responsible for the conduct of the work. Regional offices have shown individuality in their development. They differ perforce, in their mode of operation from the headquarters at Geneva, largely because the responsibilities of the regional offices are those of assisting governments directly upon request.

There is little doubt that regionalization, so liberally interpreted, has been one of the factors which has contributed most to success – particularly in securing world-wide co-operation. As the Director-General said in 1950, the increased decentralization which this permitted,

> has brought the Organization into close touch with the most immediate needs of the member countries, and has enabled WHO to begin to assist each country in taking the next appropriate step towards developing its health services within the limits of its economic, social, and cultural circumstances.[6]

THE WORLD HEALTH ORGANIZATION AT WORK

The work of the World Health Organization can be divided for the sake of convenience into two parts:

1. Central technical responsibilities
   (a) Epidemiological services
   (b) International standardization
   (c) The dissemination of knowledge
2. Services to Governments
   (a) Expert guidance on specific topics
   (b) Practical aid with short-term objectives
   (c) Practical aid with long-term objectives

1. *Central Technical Responsibilities and Activities*

In the matter of central technical services the Organization has followed in the footsteps of its predecessors. When it began in 1948, sanitary conventions had existed for a century. For nearly half this period there had been an international bureau of epidemic intelligence, and also agreements about common standards for biological products and vital records. With a larger budget and the goodwill of nearly the whole world, the approach has naturally been more vigorous and the scope greater. What was previously done on a limited scale could now be applied generally.

(a) *Epidemiological Services*. The first fruits of world-wide collaboration were seen in the control of epidemics. The muddle of sanitary conventions, of which no less than thirteen existed, was replaced by a new code adopted by the Assembly in 1951, designed to protect countries, without irksome interference with travel and freight. The new regulations differed fundamentally from what had gone before: the system of bills of health, for example, was abolished. The adoption of these new regulations was made easier by the new powers vested in the World Health Assembly. In particular, it is empowered to discuss and adopt international health regulations to which member states become parties *without positive act*. Previous international conventions took years to ratify. Procrastination now favours unanimity where before it hindered. Of a possible eighty-nine countries only twenty-five submitted limited reservations.* The International Sanitary Regulations came into operation in October 1952.[2] Concurrently, the new centre of epidemic intelligence at Geneva gradually extended its range of interest to infectious diseases of all kinds and in all countries.

Fear of invasion by quarantinable diseases – cholera, plague, typhus, relapsing fever, smallpox, and yellow fever – and the effects upon international traffic, are no longer necessarily among the chief preoccupations of health administrators. The endemic foci of these diseases have dwindled; and the frequency and extent of their occasional excursions have diminished.[9] Modern epidemiology and public health have become effective safeguards, where before little, if any, existed.

Nevertheless, although the risks have been so much reduced, there is increased need for vigilance in a world in which carriers of disease can spread with the speed of an aeroplane. 'A typhus louse or a plague flea, brushed off the rags of a beggar in an Eastern bazaar can be in Tokyo or Oslo, New York, Moscow, London or Sydney, within a few hours'[4a] – although it is not certain what harm they would do so far from their native habitat. A worldwide radio network, based on Geneva, came into use in 1948. Today, a daily bulletin of epidemic news, broadcast on nine wavelengths, can be picked up by sea ports, airports, ships at sea, and public health authorities everywhere. Regional stations of epidemiological

* A state which submits a reservation that is rejected is excluded from the operation of the regulation unless it withdraws its reservation. In 1967, 162 states and territories have accepted the International Sanitary Regulations without reservations and 28 with reservations found admissible by the World Health Assembly.

intelligence exist for the Americas (Washington) and for the Eastern Mediterranean (Alexandria).

In addition to introducing uniformity in national action at frontiers, WHO has played an important rôle in furthering epidemiological work, (1) by sponsoring and co-ordinating research into communicable diseases, and (2) by technical assistance to nations for combating the diseases themselves (see later).

The problems of infectious diseases, to which so many research workers and administrators all over the world have paid attention for many years, have lent themselves admirably to discussion in expert committees. Experts have considered and issued reports upon tuberculosis, malaria, treponematosis, poliomyelitis, onchocerciasis, rheumatic diseases, hepatitis, yellow fever, plague, cholera, smallpox, typhus and other rickettsial diseases, bilharziasis, trachoma, leprosy, rabies, brucellosis, influenza, the zoonoses (jointly with FAO), enteric infections, helminthiases, gonococcal infections, trypanosomiasis and filariasis.[2]

Epidemic intelligence – giving information about pestilential diseases, quarantine restrictions imposed or withdrawn, and details of current epidemics of, for example, influenza or poliomyelitis – is issued weekly; an epidemiological and vital statistics record is published monthly.

'Improved health facilities and the application of modern prophylaxis', says the WHO *Chronicle*, have 'greatly changed the health situation of the Mecca pilgrims and of the inhabitants of the region, where, between 1831 and 1912, forty different epidemics of plague, dysentery, typhoid and cholera were recorded during the pilgrimage seasons.' My own memories of a pilgrim voyage in 1927 are vivid.* Steaming slowly from Jeddah in the Red Sea through the Indian Ocean with 1,200 Malays, mostly sick and ailing, on the return voyage to their own lands, we had to stop daily to bury our dead. The 1966 pilgrimage, in contrast, was declared free from infection.

(b) *International Standardization.* The new Organization has pursued, like its predecessors (see Chapter 23), the endless quest for statistical perfection. The sixth revision of the international list of causes of death, which appeared in 1948, broke new ground in many ways.† The international death certificate which followed has given the opportunity, at least, to make mortality statistics valid and comparable everywhere. The national committees of vital and health statistics have been seeking to build up organizations adapted

* *Guy's Hospital Gazette*, January 1928.

† The 8th revision was adopted by the Assembly in 1966 (see p. 235).

to the needs of their own countries. Statistical centres are available for giving advice (see p. 235).

Perhaps the most remarkable achievement has been the publication of the *Pharmacopoeia Internationalis* (1st vol. 1950, 2nd vol. 1955; 2nd ed. in press 1967). This has been a long-felt want. Every nation had its own specifications, which made international comparison of drugs difficult. The great variety of new drugs, also, many of great potency, which poured out from laboratories all over the world every year, added to the need for a common reference work. Little more needs to be said about standardization of biological substances, except that WHO has continued the work. Nine new standards, for example, appeared in 1954, including one for Schick toxin as a test for susceptibility to diphtheria.

(c) *The Dissemination of Knowledge.* If existing knowledge of how to promote health and prevent diseases were to be generally applied, nine-tenths of the present volume of illness in the world would shortly disappear. The world does not lack knowledge, but rather the wisdom to apply it. But this criticism of man's good intentions overlooks the difficulties in communication, the conflict of voices, the variations in local conditions, and a dozen other barriers to a common understanding. In seeking to promote a common scientific understanding WHO may be doing more, with the least pretension, than in many other fields. What is needed is a clearing house of medical and scientific information; a machine for weighing and sifting the experience of different countries; the means to make the common accepted results available to all, governments, public, and workers in the field; and these WHO provides.

In this the *international committee of experts*, pioneered by the Geneva Office, economical to run* and infinitely elastic, has been admirably adapted to this wider purpose. During the past twenty years committees have produced reports on some forty-five different subjects, most, if not all, of those set down for prior study. In 1953, for example, committees studied and reported on the following: alcohol, biological standardization, drug addiction, environmental sanitation, health education, international pharmacopoeia, malaria, onchocerciasis, poliomyelitis, public health administration, rabies, rheumatic diseases, vaccination against tuberculosis, treponematosis, yellow fever, and protein malnutrition in infants and young children. A joint committee with UNESCO studied the mentally subnormal child. Some 2,500 scientists, who are available

* Expert committees and conferences together cost 238,000 dollars in 1966 representing 0·55 per cent of the regular budget.

to serve on expert committees in an honorary capacity, are members of 44 panels maintained for consultation on a permanent basis.

Seminars, international conferences, working parties, study groups, study tours, and research symposia, which serve the same purpose, have also been widely used. The research symposium on epilepsy, which (October 1955) sat for a week in London, illustrates both the method and its adaptation to the widening scope of public health. It consisted of ten doctors from different parts of the world, who had spent substantial periods of their lives working with epileptics. The approach to epilepsy was as to a great social problem and what could public health do about it. In September 1953 twenty-two nations sent delegates to a European conference on public health training at Göteborg Sweden. In 1955, with the object of improving the techniques of education in nutrition, which is one essential in the campaign against kwashiorkor, a joint FAO/WHO seminar was held in the Philippines.

In the world-wide malaria campaign, the *international conference* has played an important rôle in helping to synchronize plans. The first malaria conference was held at Kampala, Uganda, in 1950, to discuss control south of the Sahara, where particular difficulties have been experienced. Many local experts held the view that eradication should not be attempted where owing to high endemicity the adults were immune following childhood infections. The conference reached the unanimous opinion that '*whatever the original degree of endemicity, malaria should be controlled by modern methods as soon as possible* . . .'[18] The second conference at Bangkok (1953) was attended by fifty persons from twenty different Asian countries, representing 590,000,000 people living in malarial territories. This conference recognized the dangers of lack of co-ordination in a campaign which appeared to be a race against time; it recommended *the merging of controls wherever the malarial territories are found, irrespective of national boundaries*. The third conference in Baguio, Philippines (1954), concerned with malaria in the Western Pacific and South-East Asia, first introduced the note of urgency: the need to hasten control in order to keep ahead of resistance to the insecticides, now well advanced. This led to *the decision of the Eighth World Health Assembly to aim at world-wide eradication within ten years*. Such conferences were vitally necessary to bring out into the open the realities of malaria eradication. The 3rd Asian (1959) in New Delhi called for *careful planning*; the 4th (1962) in Manila pilloried the *absence of health infrastructures* (see p. 163). The 2nd African (1955) in Lagos stressed the

difficulties of eradication in areas with *high intensity of transmission*; the 4th (1962) at Yaoundé spoke frankly of *slow progress and disappointing results*. All very necessary and sobering.

Malaria, too, illustrated the importance of the research symposium when experts met in Rome (October 1953) to discuss the need for research into insect vectors of disease. The bogey of 'resistance' lent a note of urgency to the recommendations for research, before it was too late, into insect physiology and biochemistry.

Second to none as a means to spread understanding are the fellowships granted to doctors and other workers in the health field for travel and study abroad; five thousand have been awarded. In furtherance of antimalarial work alone, 211 fellowships were given to medical graduates, entomologists, and engineers. One of the principal stipulations is that governments benefiting must guarantee a permanent post to the 'fellow' on his return.

To all these means to further international understanding of scientific matters must be added the publications of the organization: the *Weekly Epidemiological Record*; the *WHO Chronicle*; the *Bulletin*, and the *Epidemiological and Vital Statistics Report*, issued monthly; and annual compilations *World Health Statistics Annual*; the *International Digest of Health Legislation*; *Public Health Papers*, some 50 Monographs and over 350 Technical Reports.

(d) *Applied Research.* But before knowledge can be pooled it has to be gained. One step back from the Expert Committee, the Study Group, and the Conference is the laboratory.

The experience gained by WHO during its first ten years has continually shown how much success in public health depends upon a better understanding of specific problems and of the particular local conditions under which the work has to be done. More and more, therefore, the work of WHO involves *research* which arises out of work in the field.

When a practical venture in public health meets with difficulties, these are examined for ways to find a solution, and a suitable laboratory or organization is encouraged to undertake the necessary research. Thus, WHO sponsors research; it seeks problems, defines them, stimulates others to solve them, and co-ordinates the plan of operation. Where, as in research into epidemiological problems of infectious diseases, several laboratories in different countries agree to work on the subject, they do so according to a protocol drawn up with them by the technical section of the headquarters at Geneva. About 800 laboratories are at present involved in such research.

Where the control of spread of infection depends upon survey work or upon classification and comparison of pathogens isolated all over the world, WHO sponsors special international centres. The network of WHO international and regional virus reference centres now consists of thirty in 12 countries: 2 for influenza, 8 for other respiratory viruses, 7 for entero-viruses, 9 for arboviruses, and one each for smallpox, trachoma, rickettsiae and mycoplasmas.[17a] A similar network of brucellosis centres makes possible the world-wide survey of human and animal infections with brucella. Similarly, there is a shigella centre in London and in Atlanta (Georgia), a salmonella centre in Paris and an escherichia centre in Copenhagen.

The search for new knowledge is often the only means to further success in public health work; the means to overcome or circumvent resistance in insect carriers of disease; the development of a dry smallpox vaccine stable at 45°C which will keep for two years in hot countries; the prophylaxis of rabies by serum and vaccination; the methods of spread of yellow fever in the jungle regions of Africa and South America; the means to destroy the snails in the waterways of Egypt and elsewhere – which carry bilharzia and help to produce widespread debility; the nature and prevention of kwashiorkor, the protein deficiency disease, which under 20 different names occurs in children throughout vast regions of the world; the health problems of the use of nuclear energy; these and so many other matters form the basis of research.

An early success for international research involving successive research ventures and trials in different parts of the world was in the field of deficiency diseases – goitre.[4] The first step was taken in 1949, when the subject was discussed by the first Nutrition Expert Committee. Consultants visited countries in Europe, Asia, and South America to examine the difficulties of supplying iodine to deficient populations. England, the U.S.A., and the countries of South America collaborated in research to overcome first the difficulty of iodizing crude salt, then in determining the suitability of sodium iodate, and finally in conducting field trials. In 1954, five years after the subject had first been raised at an international level, two consultants – a chemical engineer and a doctor, with extensive experience of goitre – visited sixteen countries of Latin America to advise the government on appropriate measures. The means to control goitre are now within every country's reach.

The work of stimulating and co-ordinating research, now a relatively small part of the total activity of the Organization, assumes increasing importance, as, year by year, the countries of the world

perfect their basic public health services and look increasingly for help in overcoming particular difficulties. In perhaps ten or fifteen years it may have become the major rôle.

Many hold the view that there are fields of research, closely related to the work of WHO which are best performed by an international agency; these include problems of *computation*, e.g. nomenclature, filing, adapting computer languages to biology, studying epidemiological models, monitoring drugs and pollution agents, storage of literature; of *biometry*, e.g. somatic and genetic effects of the wide range of toxic agents which increasingly polute man's environment; or of *epidemiology*, e.g. cancer, psychological illness, drugs and world phenomena generally. A proposal in 1964 to found a $43 million centre with computer laboratory and a technical staff of 700 was finally shelved by the 18th Assembly in 1965. It was decided that international monies could best be spent on action already clearly supported by existing knowledge, or alternatively that all new knowledge could be adequately sought by national research centres. The problem will surely be raised again and may well on another occasion be determined in favour.

In the meanwhile WHO has begun to develop its own research in cardiovascular disease; it has established a division of research in epidemiology and communications science; and a computer unit which appears to be steadily expanding its range of work.

The 19th Assembly (1966) accepted the plan to create an international agency for cancer research now supported (1967) by 7 countries (France, U.S., U.K., Australia, Israel, Netherlands, U.S.S.R.). This is concentrating on 'the relationship of environment to human cancer', e.g. global distribution, migrant populations, industrialization, identification of aetiological factors in liver and gastro-intestinal cancer. It maintains a close working relationship with WHO's cancer control unit.

2. *Services to Governments*

Practical aid in the field most clearly distinguishes WHO from its predecessors: although it follows in the footsteps of the Rockefeller Foundation, the first to demonstrate the practicability of mass campaigns against hookworm in 52 countries throughout the tropics before the first world war, and against yellow fever a few years later in Central and South America and Africa.

Practical aid is mainly in the form of advice, with, in some instances, special equipment and material, undertaken in close

collaboration with other specialized agencies, FAO, UNESCO, UNICEF, and ILO. WHO and UNICEF collaborate both in maternity and child health projects and malaria, yaws, and leprosy control; since these, in their different ways, are of importance to children. In malaria control, WHO provides technical advice and the services of experts, while UNICEF furnishes insecticides, spraying equipment, transport, and other necessary supplies. Some appreciable support also comes from *Technical Assistance Funds*. For malaria control directed by WHO for 1949–53 only 8·5 per cent came from the regular budget of WHO, 19·7 per cent from Technical Assistance, and 71·8 per cent from UNICEF. (Since that date the extent of aid from UNICEF in malaria eradication has much declined and in 1963 was only about 30 per cent.) Such joint schemes do something, at least in the health field, to channel the rising flood of international aid now pouring into less developed countries. In all projects the expenditure from international funds is at least equalled by national contributions. For much of the work in the field the Organization uses a permanent staff, but where problems call for special knowledge there is an effective and elastic system of temporary consultants.

Aid in the field can be in one of two forms – either (a) as expert guidance or (b) and (c) as practical projects.

(a) *Expert guidance* is the least spectacular method of giving practical aid, since it is mainly concerned with administration and organisation. In 1953 the Burmese government asked for advice in re-organising the Central Health Department; Bogotá (Colombia) and Panama sought advice about local public health services; and Turkey about the development of a sound system of health statistics. In 1963, Jordan, well advanced in its services for two million people, asked for advice on the best means to direct them. WHO consultants, assisted, willy nilly, by a team of business consultants under bilateral aid, suggested means to strengthen the central and regional administration. In 1966, a team of three consultants (Egypt, U.S.A., U.K.) advised Kuwait on its proposal to establish a medical school. The range of work is wide, varied and of the utmost importance. In any objective analysis of the work of WHO this aspect must rank high; it is economical and it deals with fundamentals. So much that is being done in public health throughout the world fails for lack of sound advice and effective administration. How great, therefore, an advance it is that high-level advice, unstinting, unprejudiced and without strings, should now be available to governments everywhere.

An important development of expert guidance has been in the field of National Planning. Most countries have experienced the frustrations of developing services over the whole field of work without the guide lines of a national plan. When the range of possibilities is so great and the resources necessarily limited; when there are conflicting claims as for hospital care on the one hand and a health infrastructure on the other; when the priorities of disease prevention have not been adequately established nor has the full pattern of staffing in all parts of the service been clearly outlined – in such circumstances confusion is inevitable; waste and frustration follow. Since 1951 a series of expert committees has studied the problem of national planning and their reports lay down the basic principles.[26] This has led in turn to Regional Seminars and meetings (as at Manila 1964 and Addis Ababa 1965) and to expert guidance on national planning from the Centre and from Regional offices to individual countries, e.g. Gabon, Mali, Niger, Sierra Leone, Liberia, Somalia, Libya and various S.A. states. This is an approach to National Health which must eventually encompass the whole world.

Practical projects can have either (b) immediate or (c) long-term objectives, i.e., they can seek to eradicate disease by a blitz or mass campaign, or, alternatively, they can use methods which rely on the establishment of permanent services or on the furtherance of education and social change.

(b) *Mass campaigns* are outstandingly the most spectacular innovation. These can be defined as: – Short-term temporary schemes for the control or eradication of a single disease, generally directed by a 'special epidemiologist'. They operate on military lines with control from a central point, irrespective of local government boundaries and generally independent of the country's permanent health service. They are concerned chiefly with primary prevention and, when made use of, secondary prevention is limited to the treatment of infectious conditions. The campaign is conducted in three phases – (1) attack, (2) consolidation, and (3) maintenance. Prior to the attack the area must be surveyed, a plan developed, and staff recruited and trained; with consolidation comes the problem of integration into the general public health service. Maintenance (see later) is a function of general public health.[23 27 28 29]

Mass campaigns depend for their success on man's ability to find an inexpensive means, chemical, biological or immunological, with which to sever the chain of causation of disease in one relatively simple operation, or at most in a limited series of such operations repeated at intervals. The weapon selected to interrupt

the epidemiological process may be employed directly against an organism or its vector, or indirectly in raising the resistance of the human host. Diseases selected for such treatment – malaria, leprosy, tuberculosis, yaws, typhus, smallpox – are all due to organisms of the bacterial, viral or protozoal world; in those due to causes other than bacteria the chain of causation cannot be severed with the ease, simplicity and finality needed to make the cost of a mass campaign worthwhile.

Mass campaigns have the following advantages: –

(1) They can be conducted as *military campaigns*. The forces of liberation, so to speak, move into the occupied country, operating a well-planned campaign, destroying ruthlessly the bacterial enemy, its vector, or its power to attack the human host.

(2) They provide their own *discipline*. This is 'built-in' by imported supervisory staff which trains and controls an army of workers.

(3) They can succeed largely without the active participation or partnership of the people of the country in which they operate. Thus they can in large measure be imposed upon the people, or at least be applied effectively in the absence of sympathy, understanding and co-operation (but difficulties do arise from human resistance, see later).

(4) They require little or no pre-existing health infrastructure for the attack phase; although (see later) they cannot be brought to a successful conclusion in its absence.

(5) They make use largely of auxiliaries, who need no lengthy education and can be trained in-service with relative ease for simple repetitive techniques.

(6) They ensure a high level of technical achievement based upon controlled trials and continuous supervision.

(7) They reduce prevalence rapidly and thus give immediate economic and other benefits, including a striking demonstration of the benefits of modern scientific medicine.

(8) They can be directed over a wide area simultaneously with a minimum of highly trained 'special epidemiologists'.

(9) They lend themselves admirably to international planning and aid.

These attributes distinguish mass campaigns from general and special forms of public health based upon services of a long term permanent character (see p. 196).

By the end of 1967 many dozens, if not hundreds, of mass campaigns had been conducted throughout the under-developed

world, generally with remarkable success. As early as 1954, WHO was helping to control tuberculosis in 28 countries; in the decade 1948-58, 200 millions were tested and 90 millions vaccinated against tuberculosis while operations against malaria, tuberculosis and treponemal infections together benefited 400 millions; by 1966 nearly 400 millions had been tuberculin tested and over 180 millions vaccinated against tuberculosis.

The design of such projects is well illustrated by the elimination of endemic typhus fever in Afghanistan (1953). In this 345,000 persons, 19,275 homes, $2\frac{1}{2}$ million pieces of clothing, 1,294 horse-drawn tongas, and 29 public baths were dusted with D.D.T. No case of typhus fever was recorded in 1954; and the country has remained free (1967).

Malaria is the outstanding example of this type of activity. As late as 1957, some 150 million persons had clinical attacks of malaria, and possibly $1\frac{1}{2}$ million died of the disease. Malaria was the subject of the first expert committee which met in Geneva in 1947. Not only was it first on the list for the ravages which it made, but also because D.D.T. and other insecticides, with prolonged residual activity, had been made available for killing adult mosquitoes. The spraying of the surfaces on which insects, gorged with blood, are likely to rest, is a weapon of remarkable potency. At some time during the ten days required for the development of infective sporozoites, most mosquitoes will have received a lethal dose. When reinfection is thus prevented, the two main malarial infections of man, even if untreated, are quick to disappear; with few exceptions, falciparum parasites do not last longer than a year and vivax two years. If the mosquito population is held in check and transmission prevented for three years there can be no more malaria parasites in the human, or the mosquito, host.

Equally remarkable has been the attack on yaws, and allied treponemal conditions, by means of penicillin, involving examination of over 100 million and the treatment of more than 25 million people. In Thailand during 1950-4 seventeen teams each consisting of a medical officer and four auxiliary workers – local people trained for two months in the epidemiology of yaws – visited the scattered villages and townships of the jungle in teams, like a judge on circuit, examining everyone and giving a single injection of PAM (penicillin G with aluminium stearate) to all sufferers.

The relative ease and simplicity of mass campaigns does not, however, mean that they can be brought to a successful conclusion without encountering obstacles. Unexpected stability in the vectors,

very high levels of endemicity, absorption of insecticide on mud walls, inaccessibility of nomadic tribes, have all in varying degree proved to be overriding difficulties, particularly in tropical Africa, where 270 millions are still exposed to the risk of malaria.[17a] Answers to these problems are slow to be found. The spectre of new strains resistant to the poison, or of mosquitoes that have learnt to avoid sprayed surfaces, has also appeared.

Resistance signifies the survival of 50% of a vector species after one hour's exposure to a defined percentage of insecticide. Resistance to one of the members often involves resistance to others in the same insecticide group, so that the local anopheline population becomes immune to several of the chlorinated hydrocarbons together.[18] Whereas in 1958 there were only two species resistant to two insecticides – Anopheles subpictus in Java to dieldrin and in India to D.D.T. and Anopheles sacharovi in Greece to both, the situation today is more grave. Double resistance, i.e., to both D.D.T. and to the hydrocarbons (B.H.C. and dieldrin), is now widespread and yearly appears in more places throughout the malarial world. Although, treble resistance, including the cyclodine group and organophosphorus compounds, has not yet appeared in the anophelines, it has done in other insects. The number of resistant anopheline species rose from 14 in 1959 to 32 in 1965.[17a] Resistance of the malaria parasite itself to chemical treatment may well prove to be a more sinister development; plasmodium falciparum (in S.E. Asia and in Brazil) has shown resistance to chloroquin.[31] Resistance to collaboration in humans themselves and their governments also develops once the memories of the disease begin to fade and the inconveniences of periodic spraying become magnified. Many communities already show this phenomenon – not surprisingly when we recall the unwillingness of Europeans to be immunised against smallpox and diphtheria, now for them forgotten maladies. All these obstacles increase the risks of reinfection, as well as the dangers of the disease itself; and they clearly militate against the final eradication of the disease. Nevertheless man keeps one ahead in the conflict with the vectors of the malaria parasite; for resistance to the new organic phosphates (diazinon, malathion, D.D.V.P.) is at an early stage; and other insecticides will follow, it is to be hoped, in regular succession. Moreover when resistance has appeared, chemicals can still reduce transmission to a level at which surveillance, with radical medication of sufferers in the residue of infection, can finally wipe out the disease. Health education can persuade resistant humans to collaborate and overcome the reluctance of

governments to provide the basic health infrastructure. Thus the eradication of malaria throughout the world, although now seen as a longer, more difficult and costly exercise than at first thought to be the case, should no longer be looked upon as a race against time. Urgency exists, because areas that have eradicated are under increased risk, often with tragic consequences, from those that have not. But the disease can be reduced by steady co-ordinated pressure to insignificant proportions, at which level it can be held with little detriment to man's health, providing always that a permanent and effective health infrastructure can be built throughout the malarial world.[27 28 29]

(c) *Practical aid with long term objectives.* With the spotlight on mass campaigns, there is a tendency to overlook or to underestimate the work undertaken by WHO in the traditional forms of Public Health. These can be defined as:—

Long-term permanent schemes to apply medical and scientific knowledge to the prevention and cure at community level of all disease. They are directed by a 'general epidemiologist' (or health officer); they form part of the permanent health service of the nation through which their control is exercised; they conform to local government boundaries; and they are concerned with consolidation and maintenance in both primary and secondary prevention.

This is traditional public health. It has enduring qualities, it covers a wide spectrum of disease, not solely that capable of attack by mass campaigns; it attacks root causes; it promotes health over a wide field; it involves people actively in the solution of their own problems; it brings together divergent forms of public health work in the field and co-ordinates home visiting; and in all these processes it brings together preventive and curative medicine.

The co-ordination of home visiting is of particular importance; since in this form it is more acceptable to the people, its impact upon the family is less disturbing and its level of efficiency over the whole range of work is higher. It is easier in this way to deal with defaulters and to overcome resistance to public health work. In trachoma campaigns, where non-attenders often come from poorer and more trachomatous families, the chance of defaulters being found is greater when a home visitor is covering all or most of the field work; when visits for any purpose can provide a useful check on the ophthalmic state of the family. Similarly visits to give advice to the mother and young child can be used to follow up tuberculosis or detect incipient malaria by the presence of fever.

But a permanent public health service cannot be brought about

by methods applicable to the mass campaign. It is slow to develop, depending upon other social developments in government and community affairs; it has to acquire discipline in its ranks for without such most of its work is stultified; it relies on health education and gradual change in fields of human behaviour most resistant to new ideas. For these reasons a permanent infrastructure (as outlined in Chapter 17) should be promoted at the outset: and not left until mass campaigns are far advanced; or, as is often the case, allowed to take second place to hospital construction.

Permanent public health services can take two forms. (a) 'special public health', which promotes the health of a particular group of the population, and (b) 'general public health', which is concerned with the health of the whole community in all its aspects. For both of these WHO organises demonstration and training projects; these although aiming at long-term objectives are, as is the case with all WHO's work, themselves of short duration. In all projects WHO aims to train counterparts to their own experts who will be able to run the service when the International Organization leaves.

Of the two, model schemes in special public health have been more popular, largely because they are both easier to comprehend and more practicable in situations where social development is retarded. Of the wide range of work the following are but examples. Model schemes have been established to demonstrate methods of maternity and child welfare (as in Taiwan, with health centres at Taiching, after 1952 and subsequently in Ceylon, Jordan, India, Libya, Turkey and elsewhere). Courses are organized for the training of midwives, statisticians, and other health workers; thus a course on practical health statistics was given in Kabul in 1953 and a two months' course in public health annually for many years to Turkish doctors in Ankara. Training in recent years has included medical supervisors, Philippines 1962; medical records officers, Bangkok 1965; medical librarians, Beirut 1964–5, and Geneva 1966; dental epidemiological methods 1964; industrial health, Alexandria 1959; occupational health, Helsinki 1962; poliomyelitis control, Prague 1961; foci of infection, USSR 1966; epidemiology and control of tuberculosis, Prague and Rome 1966. More than 40% of projects in all regions, not including fellowships, are concerned with education and training.

Projects for the development of general public health have been undertaken in a wide range of countries, including Burma, Egypt, El Salvador, Malaya, Ethiopia, Bechuanaland and other African states, again mainly by demonstration and training. Nevertheless, model public health areas, e.g., at Aung San 12 miles north of

Rangoon and at Qalyub north of Cairo; and schemes for rural health services, as in Central and South America and African states (Bechuanaland, Guatemala and Honduras) have been disappointingly few in relation to the enormity of the world wide need for permanent general public health services. The reasons for the apparent reluctance of WHO to engage in this vital work are to be found partly in the difficulties which have already been dealt with (page 196) and partly from a widespread failure of the world's leaders (including to a large extent the members of the medical profession itself) to appreciate its full significance. Discussions about general public health tend to founder for lack of such appreciation, including what is meant by an epidemiological approach to all disease, using the services of a general epidemiologist, or health officer, with the necessary post-graduate training. Some of the difficulty stems from the fact that public health in this general sense has not been universal even throughout the developed world. Some highly developed countries, strongly represented within the Assembly of the Organization and in its secretariat, have ignored this approach themselves and placed their confidence to control disease in various forms of special public health and in rising standards of social and economic development. This failure to promote long-term public health infrastructures is at the root of present difficulties in terminating mass campaigns and integrating them into general public health.

The development of a health infrastructure (as suggested in Chapter 17) has in the last resort to compete for national recognition with other community needs. From this point of view it must gain from National Planning which WHO has sought to develop in recent years (see p. 168). The real hope for the future development of health infrastructures everywhere may well lie more in this field of work than in any other.[26]

MASS CAMPAIGNS AND GENERAL PUBLIC HEALTH*

The relative value of mass campaigns and general public health is often discussed as if they were antithetic; whereas they are complementary. Success in one should lead to development in the other; the elimination of malaria, yaws or typhus gives immediate economic and health benefits, so that, freed from these debilitating diseases, the whole life of the community takes an upward surge. The demon-

* This subject is examined in more detail in an unpublished working document 'Mass campaigns and general public health', Brockington, C. F., 1963, Geneva. See also references 28, 29.

stration of a cure in a manner so dramatic helps to convince people that there is something in scientific medicine, and such a successful demonstration may be more successful in replacing folk treatment and beliefs than attempts to diffuse modern practices of preventive medicine and their theoretical justification (Erasmus)[7] (see Chapter 6). To begin with a mass campaign may well be best, providing always that steps to develop a permanent infrastructure are immediately put in hand and purposefully pursued.

The only reflection, if any, on the work of WHO is for having undertaken not too many, but too few mass campaigns; and with more emotion than reason. Jenner would have been disappointed with the tardy and slender attempts to eradicate smallpox by mass vaccination; ophthalmologists everywhere would have wished to see mass attacks on onchocerciasis, which causes blindness throughout the Volta river basin; on the other hand, all but the most sanguine of epidemiologists must have questioned the mass attacks on leprosy in advance of the means 'to sever the chain of causation in one relatively simple operation, or at most in a limited series of such operations repeated at intervals'.

Yet, mass campaigns, although of tremendous significance to the world, have, in terms of the wide spectrum of human illness, a relatively limited field of action. The great bulk of disease and ill-health is in fact outside the scope of the mass campaign, including nutritional, viral, bacterial, protozoal, helminthic and fungus diseases within the field of primary prevention and practically the whole field of secondary prevention (Conference on the application of science and technology for the benefit of less developed areas)[24]. All such can be combated only by traditional methods of public health. This is sometimes difficult and inconvenient for administrators to grasp. Penicillin can eradicate yaws, bejel, and pinta rife in Africa, the Near East, and South America; chlorinated hydrocarbons of various kinds can kill many of the insect vectors and so help to abolish malaria, typhus, and other insect-borne diseases; BCG vaccination may well do the same for tuberculosis. This is a dazzling prospect for newcomers to public health. Not for them, or so the uninitiated think, the hard road of sanitary reform, along which Edwin Chadwick drove his people during the last century. People may live in over-crowded hovels where the tubercle bacillus thrives and yet, it is thought, be saved by BCG. The urgent need to help under-developed and developing countries to escape from the morass of sickness and ill-health in which they have found themselves has always tended to force the hand of the Assembly,

and that of the relatively small secretariat entrusted with the task of putting its policies into action. In a world where 600 million lived in malarial regions, and nearly half as many under threat of yaws, the hand of the administrator naturally reached, metaphorically speaking, for the DDT spray and the penicillin syringe. It was a temptation to throw into such campaigns of eradication a large part of the slender resources of the organization. But when the jeeps have left habits remain; and we have, sadly perhaps, to accept that health in any community cannot be entirely secured with a syringe or a dusting machine. When DDT spraying is finally discontinued and the penicillin umbrella withdrawn, there remains the everpresent risk of renewal by importation from outside or by transmission from uncontrolled residues within; these risks can only be met by traditional public health epidemiology. This surveillance is, on the whole, relatively easy. Auxiliaries can be trained to recognize the early manifestation of most diseases dealt with by mass campaigns; they can recognize trachoma in its various forms, early cases of leprosy, minor manifestations of yaws; they can make house-to-house enquiries for fevers which might be malarial; they can take smears for the examination of malaria parasites; they can supervise the treatment of trachoma by teachers, parents, older children and other selected lay workers – all subject to the confirmation of diagnosis, state of development and supervision of treatment by experts at a higher level. But none of this is possible without a permanent infrastructure. Thus it is that mass campaigns, concentrated, scientific, dictatorial, are not the final answer and not even necessarily lasting in their benefits. Moreover where successful, they leave unanswered a multitude of other health problems. These are difficult lessons to learn; but on their successful indoctrination the health of the world depends.

Mass campaigns carry a grave built-in disability, namely, that they cannot ever or rarely reach finality. In Trachoma, Yaws, Malaria, Smallpox pockets of infection remain, even when the level of endemicity is reduced to near vanishing point. Under these conditions '*a ruinous "sine die" prolongation of the consolidation phase would be required until the adequate infrastructure is created* (*Alvarado*)'.[30] The teams of specialized auxiliaries are now required to do work well within the capacity of a general purpose visitor (see earlier), e.g., in the surveillance of malaria to do house-to-house visiting, enquiring for fever, taking blood for slides, arranging for examinations and giving mass medication; a large scale military machine maintained for this purpose resembles a sledge hammer

knocking in a tintack. Yaws provides clear evidence of this dilemma; for eradication involves more than penicillin. It brings into question the whole mode of life and system of values of the people affected.

"In the province of Rotburi, 50 miles from Bangkok, jeeps bumped along mud tracks to Nongkog, where 1½ years after the original injections, the yaws team was engaged in follow-up. The school, on stilts with open sides, where the examinations were performed, with the monk's *sala* and their shrine, occupied a clearing in the woods. One hundred and eighty-four persons recorded in the original census were examined in two days. Yaws in its florid state no longer existed; smiling faces replaced misery and suffering. Yet latent and active cases remained. In a social disease of this character, meticulous supervision, early detection and treatment of cases and prolonged health education provide the only real safeguard against a wholesale return. Who is to shoulder this task when international support is withdrawn? The monks, colourful, persuasive, all-pervading, are unlikely to become effective health educators. The enduring solution of the problem of yaws, as of most other diseases and public health problems, is threefold, (1) organization of public health in local units, (2) professionally trained staff, and (3) the development of social understanding. Can this be done?[3]"

In the case of yaws, too, all can be lost without a permanent infrastructure of health. Yaws and other endemic non-venereal treponematoses are found mainly in rural areas of under-developed or developing countries where social advancement is slowest. It is in these parts of the world where most difficulties arise in creating a health infrastructure.

All mass campaigns to eliminate endemic disease depend ultimately for success upon a sound public health system. The greater the success the more evident this truth becomes; for new found health now stands endangered by the lack of services whose true significance was never previously properly understood. For some years now the infrastructure has been found wanting and mass campaigns have perforce continued beyond the consolidation and maintenance phases. There's the rub. It is this consideration, rather than the bogies of resistance in its many forms, which gives most cause for concern.

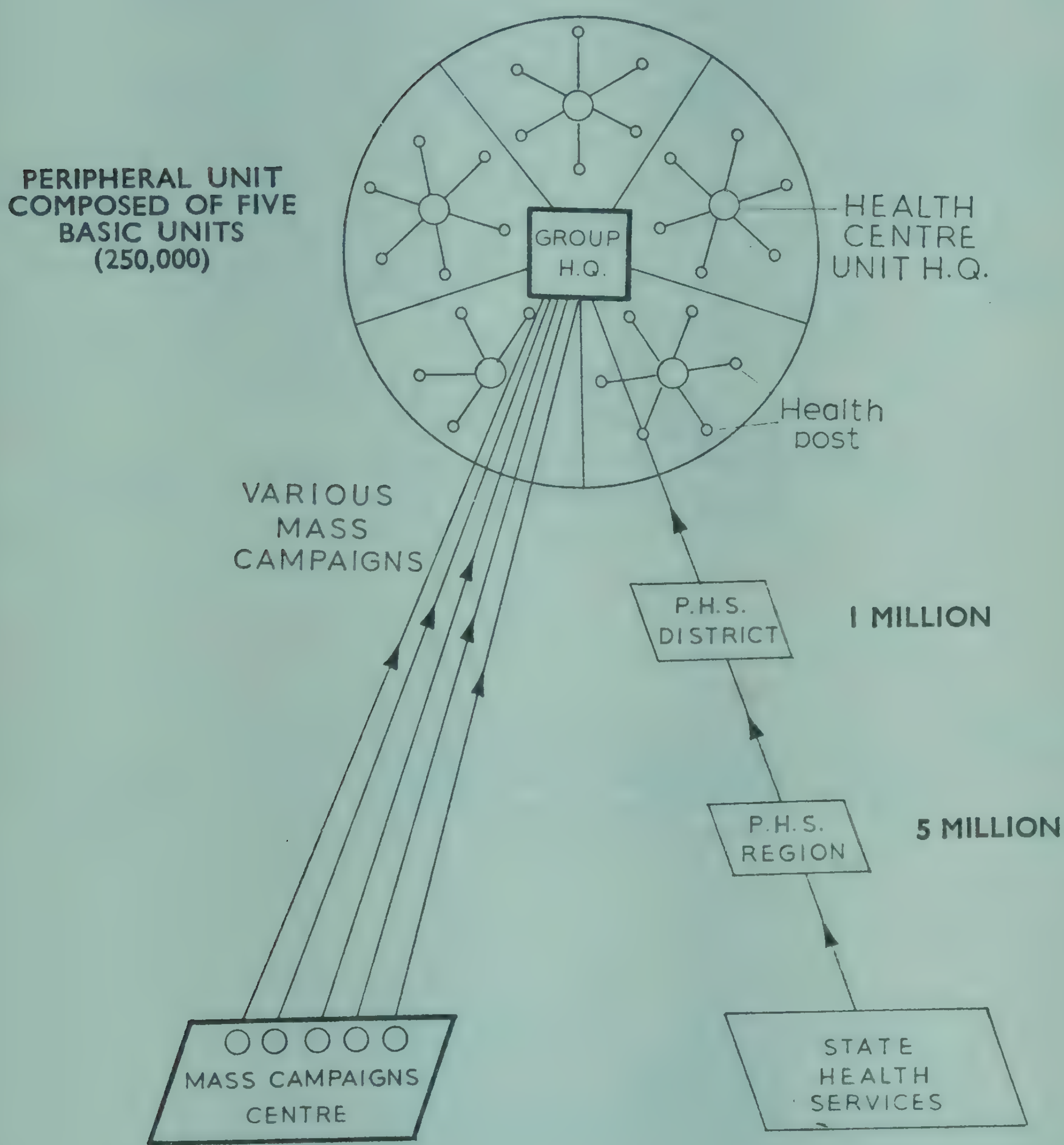
Integration of Mass Campaigns with General Public Health.

The transfer of mass campaigns to the general public health services poses delicate questions. The inadequacy of infrastructures in large parts of the world lead eventually to the concept of 'pre-eradication programmes', as a means to lay the foundations before handing over malarial campaigns to capable hands.[25] An impeccable machine for case detection involves an infrastructure not less than grade 3 (see page 166). More simple types of infrastructure will be

able to co-operate with mass campaigns; but these cannot be relied to take over at the consolidation and maintenance levels. For most parts of the world, e.g., India, such minimum infrastructures can,

STAGE ONE

TAKE-OVER BY PERIPHERAL UNIT

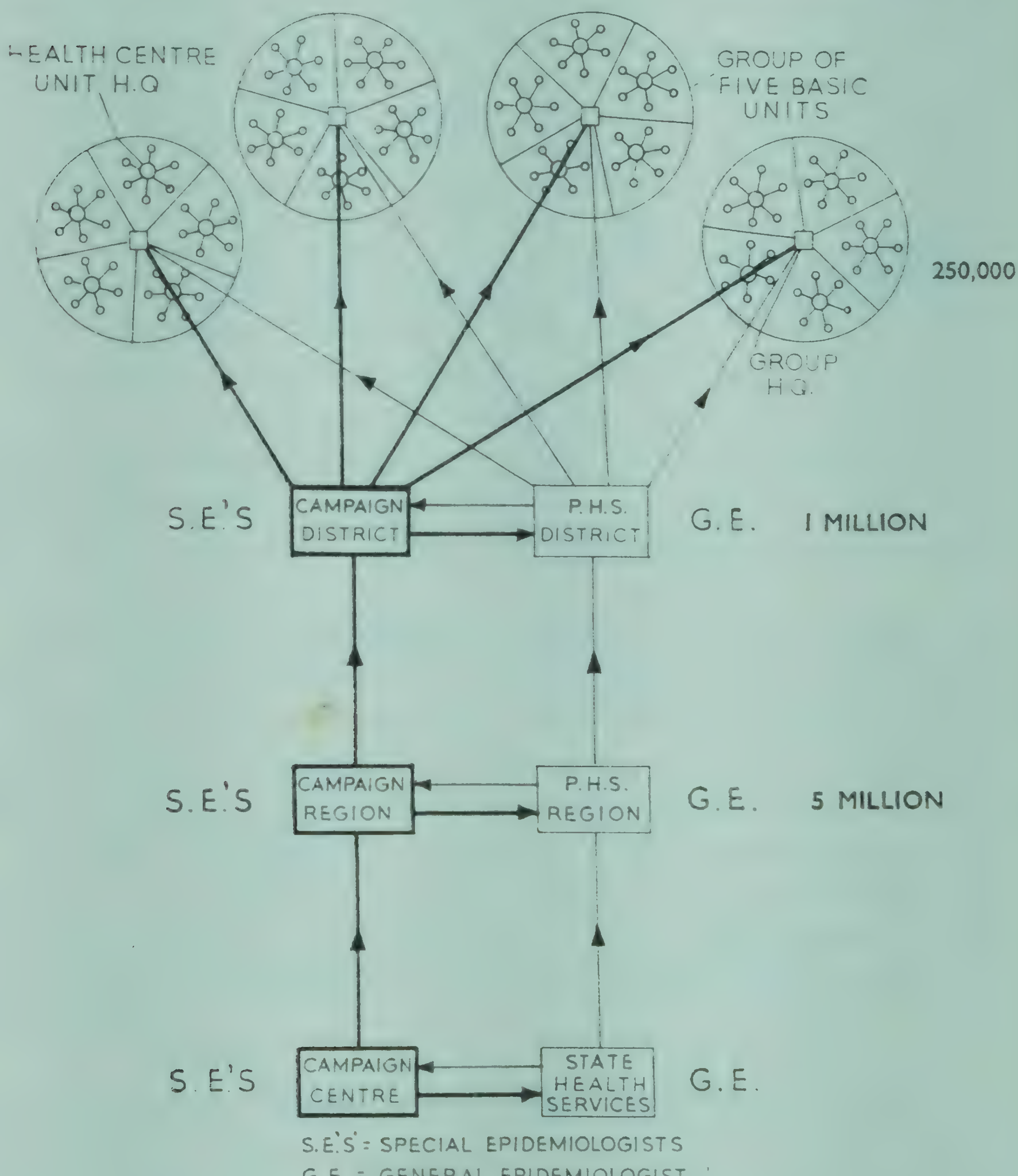


with determination, now be produced; but for many, e.g., Liberia and Togoland, lack of (1) general epidemiologists, or health officers, for work at the district level, (2) general medical practitioners for work in the health centres, and (3) auxiliaries to undertake home

visiting from health posts or district sub-centres, makes the immediate prospect of minimum infrastructures for an early take-over gloomy in the extreme.

STAGE TWO

CROSS LINKAGE AT DISTRICT, REGION AND CENTRE

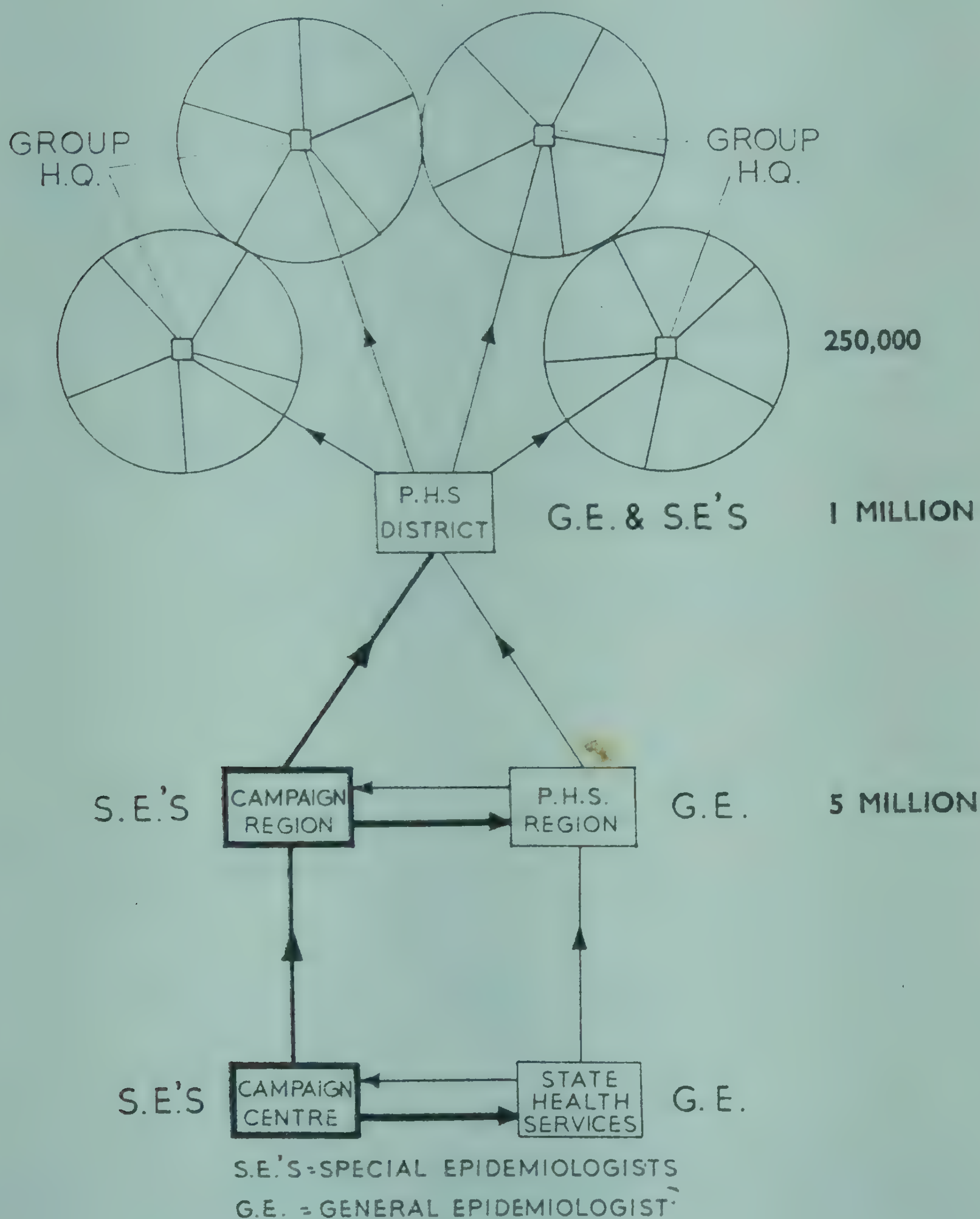


Integration should begin at the periphery and proceed by stages to the centre, as depicted in the diagrams. A complex of 5 units, covering say 250,000 people, each with a health centre and a number

of satellite district sub-centres, will be the first to take over the day-to-day work of consolidation and maintenance. This, the most difficult step in the whole process of transferring control, will need

STAGE THREE

TAKE-OVER AT DISTRICT LEVEL

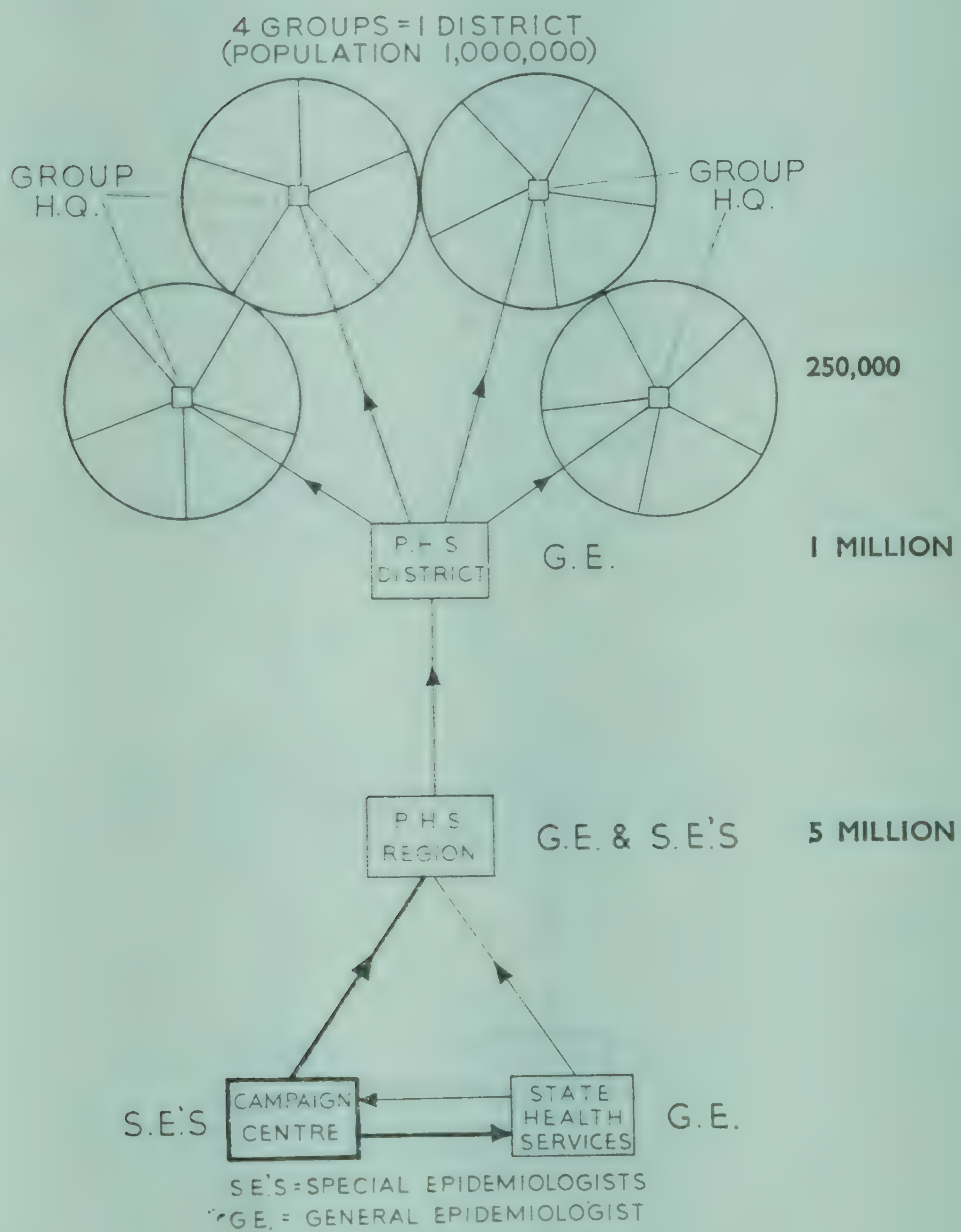


to be planned and carefully rehearsed well in advance. Subsequent stages, after suitable lapses of time, will integrate successively at district and region; and ultimately at the centre itself. Each stage of

integration will be the result of a formal decision based upon local study. Prior to integration crosslinkage should be established at each level of command; so that counterparts in the permanent

STAGE FOUR

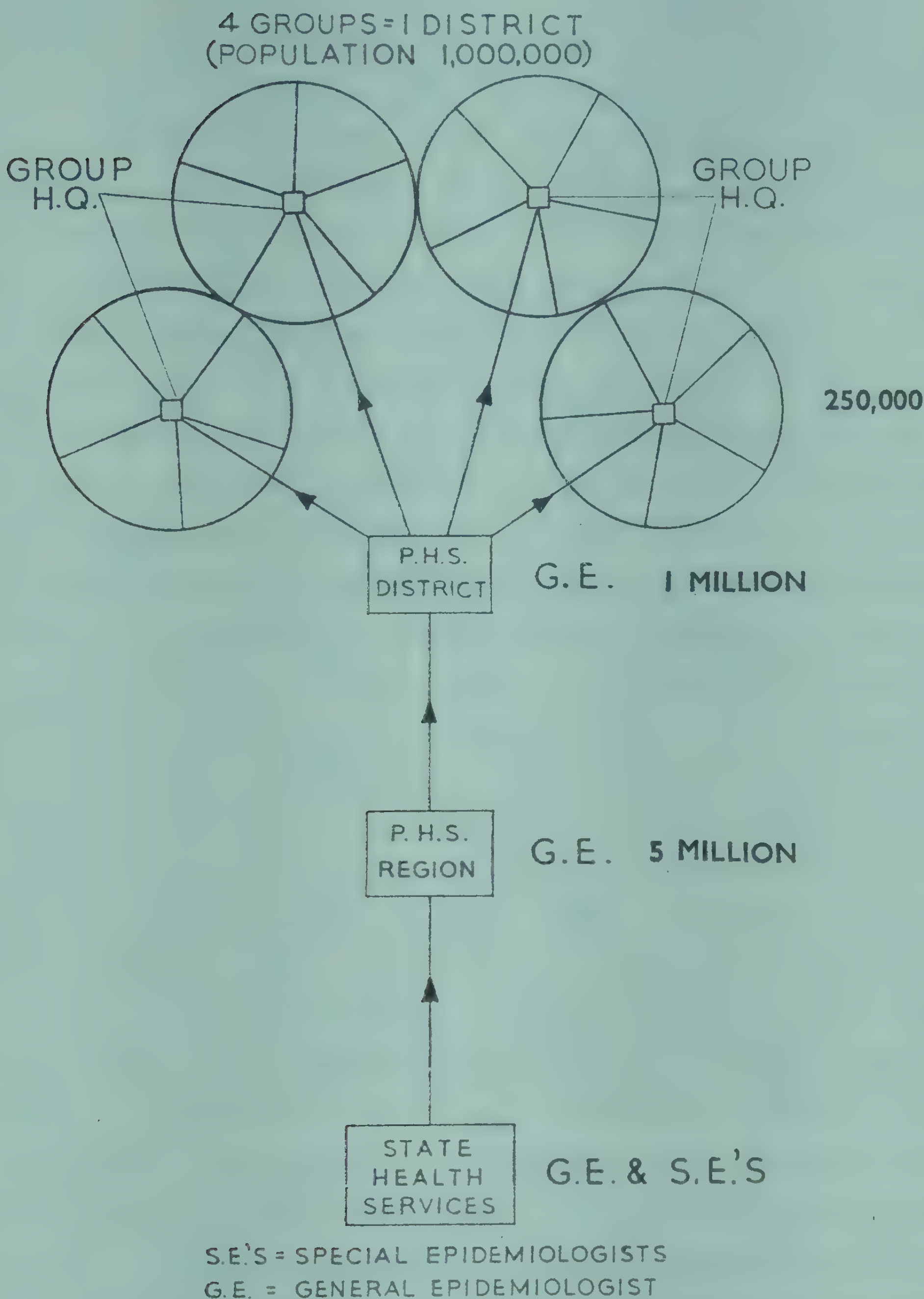
TAKE-OVER AT REGION



service are established and trained in preparation for the final transfer. At the level of the district (1 million) the special epidemiologist will hand over to a general epidemiologist (or health officer);

STAGE FIVE

TAKE-OVER AT CENTRE



at higher levels, i.e., region and centre, special epidemiologists will almost certainly need to be retained for an unspecified period of time and, indeed, possibly permanently.

THE FIRST TWENTY YEARS OF WHO

The World Health Assembly is an *international* public health authority; but not *supra-national*. The coming together of the nations

has been a remarkable gesture of goodwill, but it is easy to exaggerate the extent to which it can be translated into public health practice. The budget of the organization is not large. Fifty million dollars is soon spent among 2,400 million people, when eight out of ten harbour parasites, live in danger of deadly diseases, or suffer from malnutrition. The means at the disposal of WHO have been necessarily limited, and should not be over-estimated.

WHO must work *for, with,* and *through* governments, each being responsible for the health of its own nationals. It has no magic remedy except goodwill and cannot do the job alone. It responds to the request for help from the countries themselves; and in consequence, its scope and usefulness depend upon the expectations, resources, and values of the countries which it serves, and which must contribute a considerable proportion of the money required. Since, except in limited fields of demonstration, it is debarred from active public health work, it functions as a catalyst to foster the development of public health services and to build up international collaboration where this is necessary to success. Or it may be likened to a wise physician with a large family of sick patients scattered over the globe, who, for the most part, must bring about their own recovery. Thus we come down immediately to earth. Health may be a fundamental right irrespective of economic or social conditions, but it is none the less dependent upon them. The nations that look to WHO for guidance will sooner or later be forced to examine their own social and economic framework. This applies to all countries, not only to the developing and under-developed ones.

So much depends upon considerations of social and economic well-being, which often bar the road to progress. Sound local units of public health, for example, may tax the resources of under-developed countries to the limit and can be brought about only slowly. The advice of experts achieves nothing in itself; the establishment of a statistical machine, a venereal disease or tuberculosis service, or more widely of a sound public health administrative system, is easier to talk about than to achieve. Again, public health depends much upon a knowledge of the incidence and prevalence of disease – current, reliable, and comparable – which is not easy to get, without the social structure that is part and parcel of development and which is generally lacking. Although all may agree upon common forms of collecting data, many years must elapse before this relatively simple need is satisfied. Lack of organization inhibits accuracy and in turn uncertainty reduces efficiency. It is easy to complete the circle and return to where you started.

Many who have studied abroad return to disillusionment and frustration. Ideal schemes evolved by experts lie neglected on the desks of administrators, overworked and harassed by massive sickness, lacking the machinery of government or education, or without the doctors, nurses, sanitarians, and teachers to put them into practice. The road to health often cannot be engineered without other social services, such as education and agriculture. Perhaps too slowly we learn that the experience of the developed world cannot easily be translated, without trial and adaptation, into practical measures in less developed areas.

The impact of bilateral aid. The work of WHO is complicated by direct aid from individual governments. A U.N. agency has no political strings; it seeks not to enhance the prestige of any nation; it brings no financial rewards to any but the recipient of its favours. Bilateral aid differs in all these respects; it expresses political aspirations; it aims to improve the image of the donor; and it looks to exports without which it is often withheld. Bilateral aid in the field of health at best fulfils tasks better done by the international agency – as when mass campaigns are continued bilaterally after WHO has withdrawn from lack of funds, an unhappy reflection on the seriousness of international aid. At worst, it confuses by duplication and overlap – as when advice on administrative reorganization was given to a Middle Eastern country in parallel with WHO.

The tasks facing WHO in its first 20 years, even in the limited form of helping others to help themselves, have been bewildering in their complexity. Spurred on by the successes of science, with so much to do and so few facilities, there has been a constant risk of overstepping resources.

A beginning has been made, nothing more; the goal of mental, physical, and social health for all mankind lies far ahead. But WHO, with its limitations and imperfections, represents the belief that mankind can escape from ill-health to a better life, and that scientific knowledge is international. For its existence it depends upon international contributions, which have never yet been sufficient for the enormous task facing the world.

Yet the best that WHO gives to the world may lie in more subtle considerations. It offers to many thousands of professional men and women, who would otherwise be confined within their own narrow horizons, the opportunity to learn from the varying problems of other lands. Delegates from many nations who meet together in Geneva, Alexandria, Brazzaville, Washington, New Delhi, Manila, and Copenhagen, and the many who go abroad on study visits or

as consultants, return to their own countries fortified in spirit and enlarged in understanding. Many research workers are stimulated by interchange of experience and knowledge with other workers engaged on similar problems, whom they meet in international committees or in visits to different parts of the world.

Finally the subject of world health, perhaps more than any other, has a healing quality. Through discussion comes understanding. In a world torn with psychological dissension and suspicion of motives, the World Health Assembly may well be one of the vital sources of world peace.

> This is the thing, this truly is the thing.
> We dreamed it once. Now it has come about.
>
> EDWIN MUIR

PART SIX

THE MEASUREMENT OF HEALTH

CHAPTER 20

The Purpose of Vital and Health Statistics

WILLIAM FARR, in 1875, concluded his 35th Report with the following words:

> The great source of misery of mankind is not their numbers, but their imperfections, and the want of control over the conditions in which they live. Without embarrassing ourselves with the difficulties the vast theories of life present, there is a definite task before us – to determine, from observation, the sources of health, and the direct causes of death in the two sexes at different ages and under different conditions. The exact determination of evils is the first step towards their remedies.[66]

In 1968 we may no longer be so complacent in the belief that there is no misery for the world in numbers (see Chapter 8), but we must still agree that public health has 'to determine, from observation, the sources of health, and the direct causes of death'. One means to this end, as Farr was implying, is by statistical enumerations. Thus we learn how the community lives and dies, in much the same way as dissection of the human body, and pathological studies, have been the basis of clinical medicine. Indeed, since Farr wrote these words, mortality statistics, by showing what diseases were taking heavy toll, and in what circumstances, have quite transformed the Western world.

Vital and health statistics serve three main purposes – for research, organization, and planning.[47] For research they are needed virtually throughout the whole field of medicine and surgery. Many valuable discoveries in recent years have been achieved through statistical inquiry, such as the relationship of carcinoma of the lung with smoking (see p. 284), and the association between cardio-vascular disease and certain habits of living. For organization they provide clues as to what causes disease and what preventive measures are best applied. They provide the only measurement of health in the group. From the point of view of world health, this is our only

means of weighing up the state of health of peoples in different parts of the world and the magnitude of the problems which face them.

An understanding of what diseases exist in any community, and how they are distributed, if unhappily not always attainable, must yet always be of the greatest value in planning services, both medical and public health; and those allied social services – housing, insurance, welfare. The greater the development of a country, and the more complex its services, the more the need for strict accounting. No longer can it be assumed that expenditure of money on health is its own justification. This belief motivated the Canadian Sickness Survey:—

> In order to avoid the possibility of haphazard spending and to provide a sound basis for planning the type of health insurance which would be most suited to the actual needs of the people of Canada, it was necessary to know a great deal more about how much illness was actually occurring, what were the characteristics of the persons and families experiencing illness, how much it was costing, to what extent existing health services were being used and by whom and for what reasons, and a host of similar questions about which little or nothing was known. This was the stimulus which resulted, early in 1950, in agreement by all provinces to participate in a nation-wide sickness survey . . .[22]

It should be a fundamental consideration of all health administration that such accounting should be done. Much more accounting is needed, if national administrations are to make the best of their resources. The data will enable the health planner to determine priorities in the allocation of funds and to obtain maximum returns with minimum cost.[76a 93 94] The example can be given of an underdeveloped country with virtually no statistics of any kind – no census, no morbidity or mortality reporting whatever – wishing to begin a malaria control campaign.

> Aside from general impressions, gained from the patient-loads of its physicians and the continual processions of funeral cortèges, the country would not know the extent of its malaria problem and would be hard put to formulate an intelligent control plan.[9]

Obviously no country wishes to spray all habitations throughout its territory. It needs some measurement, in terms of incidence and mortality, of where and to what extent malaria is distributed. When the control or eradication programme is under way, it will need statistical measures of its effectiveness; when once the disease is eradicated, if it is to be kept in check, the need to know where fresh cases are occurring becomes even more urgent.

There is also a need to measure the effects of existing programmes – an operation which is now only too rarely undertaken. Doctors,

civil servants, and politicians assume all too readily that existing smoothly working administrative schemes are conducted to the best purpose. In fact, many may already have served their time; others may need radical alteration; most need considerable adjustment. The National Health Service in Great Britain raised many such important issues:

> Why did the introduction of the National Health Service in which every child could have a general practitioner make so little difference to the School Health Service? What were the appropriate rôles of School Doctor and G.P.? Did children in Leeds, Leicester, and Exeter still run three times the risk of losing their tonsils as did children of Manchester, Bradford, and Gloucester? . . . Who did the industrial medicine in the great majority of factories and other work places where there was little or no industrial health service?
>
> The last twenty years have seen many studies to explore these and other vital problems arising out of socialized medicine.

It is also too easily assumed that a service in one part of the world will be equally effective elsewhere; that what is done in England or the U.S.A. can be done to equal advantage in Central Africa. This is sometimes true. But more commonly it is false. To know what services are needed, and how they are meeting current needs, demands a skilled application of vital and health statistics. This may be called operational research, or administrative tactics – the name hardly matters.

Statistical measurements must always have been of importance, but in the modern age they have become indispensable. Vital and health statistics are the eyes and ears of the community health doctor. They are virtually his only means of knowing the nature of the problems which face him. Society everywhere throughout the world is changing fast: motor cars, smoking, women going out to work, secularization and changing rôles, penicillin and other antibiotics to be bought in a village store, and many and varied hazards of a rapidly developing industry; all these ,and much else, are interacting with one another to change the health picture and the health needs. The studies of sickness absenteeism, which were made possible by National Insurance (see p. 269), revolutionized ideas about the major causes of community sickness. Over 10 per cent of sickness absence in male industrial workers in 1951 in the U.K. was ascribed to 'bronchitis' (16 million days); 'psychological' disorders accounted for more than 13 million days.[42] Statistical studies in Malaya have shown the rise of infant mortality in rice-eating countries during times of plenty with decline in times of scarcity of food; and in Ceylon, the differences in mortality rates at different

ages during the past 25 years. What are the proper services to meet such demands?

Studies of reproductive performance according to age or type of birth were equally challenging. Stillbirths (i.e. late foetal deaths) for 'elderly primiparæ' in Great Britain in 1949[47] ran at over twice the rate of all others; the rate of neonatal deaths among multiple births was over five times that of singles; post-neonatal deaths in infants of 'young mothers with relatively large families' three times that of all others. In what way should public health services be adjusted to meet such phenomena? Studies in social class differences of mortality and morbidity (see p. 245) provide one of the most effective means to maintain health in a dynamic and ever-changing society. What the professional classes can achieve should not necessarily be beyond the capacity of others; and the diseases, such as coronary thrombosis, from which the professional classes suffer unduly need not be their inevitable lot.

Much of this will be reflected back upon the national political machine. National statistical services should provide adequate statistics, including vital statistics, which can be a basis for informed national decisions on economic and social matters and which meet international responsibilities in the field.[50]

Expenditure on medical statistics, it has been said, has 'the character of an investment, from which a full return may be expected only over a period of years. Although doctors, hospitals, and others are naturally concerned more directly with the immediate needs of their patients than with the future health of the community, or with providing the means for a health audit of the country, it would be wrong that they should, therefore, neglect the part they can play in providing for the future.'[52]

Thus, vital and health statistics should be one of the first steps in the pursuit of health throughout the world. (See also 'The uses of epidemiology'.)[47]

CHAPTER 21

The Sources of Vital and Health Statistics

VITAL STATISTICS

VITAL statistics are *the facts, systematically collected and compiled in numerical form, related to, or derived from, records of vital events*. Data used for health purposes have been limited largely to mortality (deaths and foetal deaths) and natality; but increasingly, with the growth of social medicine, use is made of other vital events, marriages, divorces, and more rarely annulments, adoptions, legitimation, and legal separations. General and specific death rates, natality and nuptiality, the state of the population, its rate of growth, its characteristics and geographical distribution are the first essentials. Morbidity data, and other information collected by public health personnel on living conditions and environmental factors, for example, nutrition, are increasingly emphasized, usually under health statistics (see below).

Mortality has been a subject of study for many centuries – at least back to the sixteenth century, when London recorded the numbers dying weekly in the city – in what were called Bills of Mortality, obtained by house-to-house visiting. It is to these records that the father of vital statistics, John Graunt, and his associate, Sir William Petty, looked, in the following century, for the studies, which showed the increase of mortality in town over country, with a higher rate of male over female births and the greater mortalities of childhood (1662) (see Chapter 10). Many others in succeeding centuries, including the Heberdens, Short, and Percival, studied the births, deaths, and marriages maintained in the ecclesiastical parish registers in England and Wales, and elsewhere throughout the West. But it is only in comparatively recent times that registration in any country has been able to provide a reliable framework for statistical analysis.

The origins of vital registration are to be found in the ecclesiastical rolls. As early as A.D. 720 some such system seems to have operated in Japan. In the Western world records of fees received were kept, for baptism – compulsory in the Church of the Middle

Ages – and for burials and weddings. Such records were deficient in many essentials; the date of registration rather than that of the event itself tended to be kept, and many vital events which did not concern the religious denominations of the parish in question were omitted. A regular system was introduced first in Spain in the fourteenth century when Cardinal Ximenes, Archbishop of Toledo, required parish registers to be kept. In 1501, Germany began regular and continuous registration at Augsburg. Thomas Cromwell, Vicar-General, is said to have introduced a compulsory system of ecclesiastical registration to England in 1538 – followed by France (1539), Sweden (1608), Canada (1620), Finland (1628), and Denmark (1646).[20]

Civil registration is said to have been begun by the Incas in Peru; being without written characters they intertwined coloured strings and knots to record the facts. Massachusetts, then the British colony of Massachusetts Bay, introduced legislation for civil registration in 1639. France followed with the Napoleonic Code in 1792. The civil section of the Napoleonic Code was destined to influence strongly the development of vital registration throughout Western Europe, Latin America, and parts of the Middle East, which came under French influence.

A state system of registration in England and Wales began in 1837, when the clergy were relieved of functions previously placed upon them, and a new machinery with a general register office in London, and local registries, was instituted under the direction of the Registrar General. Registration became compulsory in 1874. At this time also a doctor's signature was first required on all death certificates. A certain measure of secrecy was introduced in 1926, giving effect to the recommendation of the Royal Commission on Venereal Disease (1916, Cmd. 8189). The Births and Deaths Registration Act (1926), re-enacted in 1953, enacts that:

> The doctor in attendance during the person's last illness shall sign a certificate in the prescribed form stating to the best of his knowledge and belief the cause of death and *shall forthwith deliver the certificate to the Registrar.*

The advantages are often lost when the doctor 'delivers' the certificate by handing it himself to the relative.

Because of the fact that 'registration of vital events for legal purposes is an almost universal requirement', statistical processing of the record of registration has become the accepted or conventional method of producing vital statistics. Nevertheless alternative methods have been used – notably in the North American continent,

by the use of census enumeration. Surveys have also been used, as, for example, in Rhodesia (1948)[59] and more recently in India[37] (see Chapter 26).

The content of statistical reports has now been laid down in detail by the United Nations (see p. 239). The range and extent of fact to be recorded is set out in two stages of priority, so that countries with few facilities, and many difficulties, can begin on a less ambitious level. The first priority record, for example, for live births, includes nine items: date of occurrence and registration, sex, age and parity of mother, place of confinement, legitimacy, attendant at birth, and whether the birth was single or multiple. For those that have the necessary machinery and social conditions a further ten items are recommended: period of gestation, weight at birth, date of marriage, occupation, industry and status as employer or employee, education, usual place of residence for mother, hospitalization, and age of father. The information actually made available on the registration certificate varies greatly (see Chapter 22).

Vital statistics depend upon registered documents, i.e. documents filed for legal purposes, in which the informant generally has an interest in the validity of the data and their recording. For this reason alone it is important that such documents should not be overburdened. Even the first priorities may unfortunately be too burdensome for under-developed countries in which remoteness, illiteracy, lack of understanding of the purposes of vital records, and lack of qualified personnel to complete reliable certificates combine to make such a service impracticable. Although the United Nations report sets out these forms as neither a maximum nor a minimum, but as 'desirable', it is hoped that countries will achieve at least this minimum as soon as possible.

HEALTH STATISTICS

Health statistics have a wider connotation than vital statistics. They cover three measurements: (a) *of the state of health* – chiefly morbidity data, which relate to the distribution of illness (as distinct from mortality) in the population; (b) of *factors affecting health*; and (c) *of items of service* – all, or most, of which are to promote health, to protect the health of the community, or to treat sickness. Health statistics, therefore, are a means to measure not only health – whatever that may mean – but also factors influencing it and the steps which a community takes to produce it.

Measurements of the State of Health. The sources of morbidity data are more varied, and less stereotyped, than those of mortality data. Many arise as a by-product of the development of services. Generally speaking, the more developed the country, the richer will be the possible sources, although this does not mean that the material will be used. The main sources can be listed as follows:[81]

(1) Surveys by individual inquiry (for example, home visiting) – see p. 282.
(2) Mass screening.
(3) Census enumeration: (i) of sick persons, (ii) of certain defects.
(4) Notification of communicable diseases.
(5) Registration of certain diseases (for example, cancer, rheumatism, etc.).
(6) Certification of certain conditions (for example, for special benefits such as food allowances).
(7) Road accidents.
(8) Industry and occupation: (i) accidents, (ii) diseases, (iii) absenteeism.
(9) Armed forces: sickness and recruitment records.
(10) Insurance schemes: (i) social security – voluntary and statutory, (ii) life and sickness insurance, (iii) voluntary health pensions funds, (iv) pensioners and veterans.
(11) Medical and nursing care: (i) hospitals – in-patients and out-patients, (ii) general medical practice, (iii) home visiting and nursing service, (iv) special clinics and hospitals, agencies, (v) health and welfare centres (maternity, infant, and pre-school), (vi) educational institutions (routine inspections, sickness, absenteeism).

Measurement of Factors Affecting Health. The sources of information for an assessment of the factors affecting health and of the means to health are to be found in *analyses of the use and development of public health services,* as, for example, (a) maternal and child health services – the number of centres, of mothers attending, of individual consultations; (b) tuberculosis service – the number of dispensaries, sanatoria, beds, patients admitted; (c) venereal disease services – the number of centres, the amount of contact tracing, etc.; (d) environmental sanitation – details of services; (e) health education – courses of instruction; (f) vaccination and immunization – numbers protected.

Measurements of items of service and estimates of services available for medical care, as, for example, (a) general and special hospitals – numbers and beds; (b) mental and mental deficiency hospitals – numbers, beds, vacancies, patient admissions and discharges; (c) doctors, dentists, nurses, pharmacists, sanitarians, and veterinarians – numbers; (d) family expenditure for each of the various types of health service. There are others which can be devised for particular inquiries.

The assumption which lies behind the statistical study of service is: the more the better. Thus, if Jordan has say 4,000 hospital beds

occupied each for 300 days, there would be 1·2 million hospital days or 600 per 1,000 inhabitants, as compared with perhaps 4 times this amount in the United States .The axiom is true only in a general sense. Services tend to be concentrated in towns and to be lacking in rural areas. In some instances, liberal provision of services – for example, sanatoria and dentists – may be an indication of bad health. Many variables in population, age and density, communications, efficiency and skill, and in the continued prevalence of controllable but uninhibited health hazards also need to be taken into account in any assessment made. Perhaps, also, the use made of services is a better indication of health than their mere presence.

The data for health statistics are obtained from records which are made for statistical or other purposes connected in one way or another with the administration of the health services; they are not registered documents and the persons involved, generally speaking, have no interest in the validity of the data or its recording. This has many repercussions on the validity, completeness, and accessibility of the data.

POPULATION STATISTICS[68]

The *population census* in most developed countries is taken decennially. Census enumerations have been a feature of most civilizations throughout history – in association with conscription, collection of taxes, and other unpleasant events. In modern times perhaps the earliest enumerations were in the British and French colonies of Canada (1665) and in Iceland (1703). Census-taking in Europe dates from 1748 in Sweden and 1769 in Denmark. Most of the European countries followed suit in the latter part of the eighteenth century. The constitution of the United States of America (1790) prescribed a decennial census as a means for making a fair distribution among the States of seats in Congress. Britain did not take this important step until 1801 – after a lengthy argument covering fifty years, as to the dangers of interfering with private liberty and contravening Christian teaching.[16] The apocryphal story of the excited Member of the House of Commons, who protested so indignantly, now echoes down the ages. 'I do not believe that there is any set of men, indeed any individual of the human species, so presumptuous or so abandoned as to make the proposal . . . I hold this project to be totally subversive to the last remains of English liberty.'

A great change of outlook, making a study of this nature more acceptable to British people, had resulted from the publication in

1798 by Thomas Malthus of his *Essay on the Principles of Population,* in which he postulated that population must advance geometrically and food arithemtically – so that population must outrun supply unless checked by 'moral restraint, vice, or misery'.[39] English liberties have survived and perhaps been strengthened by the decennial census, which with unavoidable breaks has been held for the last 160 years.

Throughout the nineteenth century, most countries of the world took to this expedient. Russia was late in the field (1897), Turkey still later (1927). By 1953 few countries, Afghanistan among them, remained unnumbered.

Most modern censuses provide not only information about the inhabitants, but also much detail about their living conditions – composition of families, race, religion, occupation, etc. During the past forty years, particularly after the formation of the League of Nations, and more recently under the United Nations, there has been progress towards uniformity; so that today over eighty nations have more or less comparable census statistics. The number and nature of items included on the census schedule are many and vary from country to country, and from census to census within the same country. National needs and interest, as well as previous census experience, determine in large part the items to be investigated. Sex, age, marital status, and economic characteristics are almost universally investigated; citizenship, place of birth, religion, education, language, race, physical and mental defects are other characteristics often investigated in population censuses.

The population commission of the United Nations[21] in 1948 gave a list of twelve items, as recommended subjects without regard to relative importance: (1) total population, (2) sex, (3) age, (4) marital status, (5) place of birth, (6) citizenship, (7) mother tongue, (8) educational characteristics, (9) fertility data, (10) economic characteristics (total economically active and inactive population; occupation, industry, and industrial status; population dependent on various types of economic activities; agricultural population), (11) urban and rural population, (12) households. Approximately this minimum was effectively used in the 1950 Pan-American census. The topics recommended in '*Principles and Recommendations for the 1970 Population Census*' (U.N. 1967) were more detailed (e.g. place of residence, relation to head of household, children living and born alive, school attendance, educational attainment).

The relationship of the census data to vital and health statistics is obvious, but two examples may be quoted. Occupation gives the

population at risk for the calculation of occupational and social class mortality (see p. 245); and the number of rooms coupled with the persons living in the house makes it possible to calculate the density of living, either as an average of persons per room or in proportions living at various density levels. From this it is possible to determine the relationship of infant mortality and tuberculosis, etc., to the density of household living.

The census grows in importance. In spite of the increasing body of statistical data available from other sources and of the increasing use nowadays of other methods of obtaining necessary basic material for purposes of government, a periodical census of the whole population still remains a unique and indispensable instrument.[6]

In under-developed countries where registration of vital statistics is usually inadequate, the census is all the more important, because it provides the only source of information on such questions as fertility, mortality and migration.[21] In an African seminar,[56] the following minimum was suggested: (1) *de facto* or *de jure* domicile, (2) relationship to head of household, (3) sex, (4) age, or failing that, age group, (5) tribe or race (or citizenship where applicable). Further to these it was suggested that a high priority be given to questions on literacy, birthplace, and marital status; a lower priority to questions relating to economic status (occupation, industry, status), and lowest to questions on the total number of children born to each woman, and the numbers still living. Age may need to be estimated, and the population placed in physiological age groups – sucklings (up to two years), young (from weaning to puberty), adults (from puberty to menopause in women and longer in males), old people (past work).[11]

HEALTH INDICATORS[73, 84]

Vital and health statistics provide the basic material for a judgement of health in a community; but the search for indices, or health indicators, has engaged the attention of statisticians since the time of Graunt, and is likely to continue to do so for many years. Health indicators may be either comprehensive or specific. When all relevant aspects of any of the three groups of health statistics is complete – this might then be called a comprehensive indicator of type (a), (b), or (c) (see p. 220) – otherwise the *proportional mortality ratio, the expectation of life*, or *the crude death rate* can be calculated. The PMR (Swaroop), defined as the number of deaths at age fifty and over as a percentage of total deaths, is the most recent addition. If

everyone survives to the age of fifty, the proposed index would be 100, and if no one does, it would be zero.[84] Specific indicators are infant mortality and deaths from communicable diseases per 100,000 – including all infective and parasitic diseases listed in the International Classification. Satisfactory specific indicators for health services and activities – calculations of the percentage of population receiving protected water supplies and having facilities for proper disposal of excreta, indices of mental health, of nutrition, etc. – have yet to be devised.

Most indicators are in terms of the group – family, household, sections of the community, or the population of the country as a whole (the macro-approach); assessments of individual health (the micro-approach), possibly by surveys (see Chapters 25 and 26), should be equally significant.

Indices of health should satisfy the following conditions: (1) records should be available on a national scale, (2) terms and procedures used in recording, classifying, and tabulation data should be comparable, (3) the indicator should reflect the effect of as wide a variety of factors influencing health as possible, and (4) if a choice is to be made from several indicators (in terms of (3) above), preference should be given to the most sensitive, i.e., the one which will best reflect variations.[84] So many existing indices fail in one or more of these requirements. More research is needed before valid and comparable indicators can be used effectively.

CHAPTER 22

The Inadequacy of Vital and Health Statistics

THREE TYPES OF AREA

NOTWITHSTANDING their importance, vital and health statistics have not reached a high level of development throughout the world. Countries have been classified as follows:

(A) Those with no complete enumeration of population and lacking, or with only slightly developed, public health and vital registration systems.

(B) Those with an over-all or partial census and with a well-developed public health and vital registration system for parts of the population (for example, for large towns), but not for all.

(c) Those with an over-all census and well-developed facilities for obtaining morbidity statistics.[81]

In Group B, areas with 'well-developed systems' are limited mainly to a few large towns, as, for example, Bandung, cited later, in Java, or Bangkok in Thailand.

DEFICIENCIES OF STATISTICS

Vital Statistics

Registration. Although the nucleus of a registration system is one of the earliest developments of government in any area, yet international comparability of vital statistics, the oldest type of statistical compilation, has not yet been achieved, except perhaps in some areas within Group C. Vital statistics, even in developed areas, are subject to many inaccuracies. In the U.S.A., for example, Moriyama reported (1954) that, for a number of counties, death rates were much lower than could be accounted for 'on the basis of known mortality levels and age distribution; in many small areas, incomplete registration makes it impossible to interpret the death rates'.[43]

The less the country is developed, and hence in those territories with the greatest problems, the more defective are the vital statistics; the greater the need the less the supply – a phenomenon much less marked in the fields of finance, trade, industry, and production. 'No country in S.-E. Asia, other than Ceylon, has adequate records of vital statistics on a nationwide basis, even for demographic purposes.'[12] In many, where some data are available, their quality is deficient. These deficiencies are partly due to the fact that the need for vital records develops only as school systems, pensions, social security, and other social measures require people to declare their age. Compulsory registration is difficult to introduce, with any chance of success, much before the corresponding certificates are required at various stages of an individual's life; until, for example, age must be known on entry to school or employment or at death for insurance or inheritance claims.

In 1956 of 214 countries in the world, statistics were available in some form for only 168. Of these, 58 were recorded as 'complete', i.e., somewhere over 90 per cent; 56 as 'incomplete', i.e., less than 90 per cent, and 54 were unknown and almost certainly non-existent. 19 of the 168 areas had statistics referring to only part of the national territory; in 24, or possibly 27, instances they referred to certain ethnic groups. The annual questionnaire sent out by the United Nations showed (1954) that for half of the world's population, vital

information of the simplest kind only is available.[61] Of the 214 statistical areas of the world, 130 reported total live births, covering 1,242,448,000 people, or 50·5 per cent of the world's population; 131 reported total deaths at approximately the same figure; 108 only reported total infant deaths, covering 1,148,729,000 people, or 46·8 per cent of the world's population.[70] For the years 1951–5, 38 million births were registered (42 per cent of 90 million), and 16 million deaths (33 per cent of 47 million). Where vital events are said to be completely registered – this is of course relative – the information which is tabulated varies greatly. Thus, up to 1954, of the 58 areas covering almost exactly half of the world's total population (1954), i.e., 1,229,076,000 people, only 7 classified deaths by age, sex, and occupation; the occupation of father of a new-born baby was recorded in only 22, and that of the deceased in 24, instances out of 58.[70] Total figures of births, deaths, infant deaths, and stillbirths only could be said to be generally available. Nor is the need for improvement limited to under-developed areas. Improvements are, however, continuously taking place – birth weight and period of gestation have recently been added by some developed countries.

In the remainder of the world, covering over 1,200,000,000 people, the data for vital statistics were certainly even more incomplete. The statistics of infant mortality, which have long been regarded as a good index of unhealthiness of localities in the developed world, are generally quite unreliable elsewhere. Little distinction may be made between live births and stillbirths; and the definition of first birthday can also vary considerably – it may be taken from the date of conception and not from birth, or periods of time may be measured by successive harvests, or the first birthday may be dated from some conspicuous festival.[11] More serious perhaps is the fact that the population against which the rates are calculated may be guesswork, or that only a proportion of the vital events may have been recorded, thus giving a distorted result. Africa, particularly tropical and southern, and Asia, particularly East, are most defective in their returns; here not more than 10 per cent of events are registered.

By 1966, although the collection of good vital and health statistics had improved, the actual appreciation of them left much to be desired. 'Many administrators today not only do not obtain adequate statistical data . . . but have come to regard them as unnecessary.'[35a]

Foetal Deaths. No country has ever reported all foetal deaths, although it is known that at least 14 have adopted the new definition (see p. 238). The stillbirth, or late foetal death, which has been registered relatively recently (1928 in U.K.), is subject to so many

difficulties of interpretation and recording that the statistics are of little value for international comparison, although, where they exist, they are useful for long-term analysis in the country itself. The criteria of viability vary much. The minimum period of gestation most frequently specified is 28 weeks. But in 12 countries the gestation period is 26 weeks or more (Belgium, Bulgaria, Colombia, Egypt, Finland, France, Italy, Liechtenstein, Luxembourg, Mauritius, Netherlands, and Venezuela); in three countries 20 weeks (Panama, Philippines, and United States) and, prior to 1953, in Japan 3 months. Confusion also arises over the use of calendar and lunar months. A few countries make confusion worse confounded by including as stillbirths those babies that die shortly after birth, either within 24 hours (for example, Cuba), or before registration (for example, Pakistan, Netherlands Antilles, Algeria).[20]

Even under highly efficient registration systems, many stillbirths escape registration, so that many countries with relatively adequate statistics of live births and deaths may have quite inadequate stillbirth statistics. Nevertheless, it is sometimes difficult to identify incompleteness, particularly where stillbirths and live births are both under-registered. Perhaps the most that can be said is that the information in countries where most confinements are medically attended is more complete than in others. The value of such information to public health is so great that every country should give the matter serious consideration.

Population Statistics

Population statistics, which form the basis for most specific vital and health statistics, are subject to many errors. Even in developed countries (Group C) the probabilities of omission from the census, particularly of infants, are considerable. In the United States of America, for example, in 1940, 6·3 per cent of white natives and 15·2 per cent of Negro children under five years of age were missed.[69] More recently Moriyama reported (1954) that registration of birth was 'close to 98 per cent and in almost half the States . . . 99 per cent or better'.[43]

In countries of Groups A and B, with poor communications and a low level of education, the margin of error is considerable, even if any records at all exist. Woytinsky considered that 'about a third of our statistics for world population are derived from rough estimates and doubtful sources and about two-thirds from more or less reliable enumerations'.[95] The Statistical Office of the United Nations

describes the population statistics of Africa, the Near East, and the Far East, excluding Japan, as 'poor'; reports for Latin America, Central Asia, the U.S.S.R., and Eastern Europe 'fair'; only those from the rest of Europe, the United States of America, Canada, Japan, and Oceania, are described as 'good'.[75] Figures for such countries as Ethiopia, Liberia, Afghanistan, Iran, Turkey, Korea, Thailand, Indo-China, and Peru, are still mainly guesswork.[35]

Population statistics in large parts of the world are also at the mercy of intra-national migrations – of which accurate records are difficult to obtain. In particular the movement towards towns, everywhere throughout the world, presents great difficulties. In under-developed countries, countryfolk move in over night to camp in open spaces and even in the streets. The slender resources of the local government department are often unequal to the task of keeping account of them.

The range of enquiry in censuses continues to be limited and few countries reach the 12 items recommended by the UN Population Commission (1948) (see p. 218). In 1964, of 224 countries 177 had one or more censuses taken between 1955–64. Sex was recorded in 163, marital status in 103, country of birth in 92, level of education in 78, religion in 74, illiteracy in 71, age in 71 (but grouped age in 143), ethnic composition in 68, school attendance in 62, females by age and children born alive 50 and by age and children living 16. In the economically active population, the range fell from 119 for sex to 38 for marital status of females and 34 for marital status and age.[75a]

Health Statistics

Health statistics are scattered among many government departments; for example, the Ministries of social welfare (national insurance returns, hospital statistics), of defence (army, navy, and air force health statistics); and of education (school medical inspection, numbers of students and graduates in medicine and in allied professions). Many of these are accurate, as those for hospitals, staff, investigations and data from clinics; but there are often difficulties to be overcome in obtaining comprehensive data. The fact that health and welfare in many countries are the responsibility of provincial and municipal authorities, and that the relevant statistics are often not uniform, or on occasions not even available in the central government administration, complicates studies, particularly in countries with a federal organization. In addition, the most advanced

countries have decentralized forms of government; and many private or voluntary organizations, hospitals, clinics, etc., do not furnish statistics to the national authorities. To compile a complete list of existing health statistics in any one country often requires many months of search in publications and reports and in correspondence with national administrators.

In June 1953, WHO sent out a questionnaire to all member-states in an attempt to learn to what extent health statistics were available in various countries.[61] The information was summarized under 11 headings (excluding notifiable diseases): (1) morbidity data (all illness and special); (2) infirmities (blind and deaf mute); (3) medical and public health personnel; (4) hospitals (number, beds, smallpox); (5) immunization and vaccination (diphtheria, B.C.G., other); (6) maternal and child health centres; (7) tuberculosis (pulmonary, non-pulmonary); (8) venereal diseases; (9) drug addiction and alcoholism; (10) mental health (hospitals, institutions for mentally subnormal children); (11) homes for incurables and aged. Few countries answered fully. Of the 95 returns listed, 28* only gave sources of morbidity data. Planned surveys of sickness were conducted by Canada, Japan, England and Wales, Scotland, Northern Ireland, Ceylon, and Denmark (see Surveys, Chapters 25 and 26). Otherwise there was little available, except records of communicable diseases and some information from hospitals, insurance, and school examinations. But questionnaires of this character are notoriously difficult to fill in – as they are to frame – and it may well be that the actual position is better than here shown. Certain types of health statistics are at a high level; yet it is certain that morbidity and some other health statistics, being more difficult to collect, are less recorded than vital statistics which we have already seen to be inadequate.

In 1965, a questionnaire specifically designed to elucidate the state of morbidity statistics was returned by 98 countries. Clearly improvement in recording, if only limited, had occurred particularly in hospital data. But there was little evidence that the particular health needs were reflected in the data collected; and too obviously traditional and often outworn practices were slavishly adopted. The most important single criterion of merit in morbidity statistics, after reliability, must be *relevance*. The chief worldwide need, today, in

* Union of South Africa, Anglo-Egyptian Sudan, Belgian Congo, Morocco (Fr. Protectorate), U.K. overseas territories, Africa, Europe, America and Asia, Rhodesia, Canada, Colombia, Japan, Laos, Austria, Belgium, Finland, France, Germany (Federal Republic), Greece, Italy, Norway, England and Wales, Northern Ireland, Scotland, Yugoslavia, Nauru, New Guinea, and Papua.

this respect is for countries to collect morbidity data *relevant to their particular problems* and sufficiently flexible to remain relevant as the problems change.[88]

Under-developed countries are again at a disadvantage with health statistics, yet their need of these is even greater. If the many hazards to health 'are to be combated successfully, certain basic facts concerning them must be recorded with precision, and the assembly of the necessary facts must not be limited to records of compulsory notifiable diseases if gaps in existing medical knowledge are to be filled'.[11]

The Development of National Committees[86]

Vital and health statistics are means to an end – to build up each nation's health. International comparisons of the health of different regions of the world can help to point the way, but the chief value must always be national. The first objective of any nation must be to produce satisfactory records for its own use, according to the nature and stage of its own economic development. There is hardly one record which is essential to every nation; not even the registration of vital events – births, deaths, marriages, divorces, adoptions – will have much use, for example, in a nomadic society. The greater the development of the country, generally speaking, the wider the use of vital and health statistics; but the needs of different countries will always vary.

Article 64 of the Constitution of WHO states that each member 'shall provide statistical and epidemiological reports in a manner to be determined by the Health Assembly'. This calls for uniformity, in materials, methods, and tabulations, for a minimum set of statistics. Even this minimum, which it is hoped to extend, has not yet been generally achieved, although the 1950 and 1960 censuses of the Pan-American states has shown that it is practicable.[73a]

Many of the means of collection of national statistical data are of a relatively primitive character: in many circumstances unsuited to the production of current, reliable, and comparable data, upon which health organizations depend for the development of services and the United Nations for its analysis of world health conditions. Furthermore, it has often been overlooked that vital statistics and population are closely related; and that, in order to relate vital statistics to the corresponding population, both must cover the same area and use the same definitions and classifications. There is a similar failure to recognize the interrelationship of health and vital statistics.

In an effort to meet this situation the 6th International Conference for the Revision of the International List of Causes of Death (1948) recommended that all nations should establish *National Committees on Vital and Health Statistics,* which could (1) work on problems of an international nature, and (2) improve the production of national vital and health statistics. By 1967, 48 countries had responded.[83] The national committees working within their own framework have begun the long uphill task of bringing satisfactory schemes into operation, relating population to vital and health statistics, helping to bring together the work of many departments, studying health statistics in relation to family structure, social, economic, and occupational backgrounds, and assisting schools of medicine and public health in the problems of education.

The first and only international conference of national committees held in October 1953, in London, was attended by 28 member-states and associate members of the World Health Organization:[82] Australia, Belgium, Canada, Costa Rica, Denmark, Dominican Republic, Ecuador, Federal Republic of Germany, Finland, France, India, Iraq, Ireland, Israel, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Thailand, Tunisia, United Kingdom of Britain and Northern Ireland, U.S.A., Venezuela, and Yugoslavia. It laid down as the objectives of national committees: to help in assessing needs for vital and health statistics, the recording of the minimum core, the free flow of information, and the co-ordination of the activities of diverse agencies; to make vital and health statistics of greater practical use and appeal; to stimulate statistical studies and the training of personnel; and to assist in the implementation of international recommendations.

In addition to the obvious call to all other governments to follow suit, it also recommended that:

(1) its functions should normally be advisory and consultative, in response to requests from the appropriate government authority. . . .
(2) its membership should include administrative, professional, and lay persons concerned with the collection and analysis of health and vital statistics and with the various uses (medical and social) of such statistics; for example,

- (a) at the national level, persons from governmental and non-governmental institutions and agencies concerned, from the medical profession, from the universities, from research institutions; and
- (b) at the regional and local levels, persons from local and regional governmental and non-governmental institutions and agencies concerned with the collection and use of such statistics, and other competent persons concerned with the specifically regional or local aspects of such collection and use.

The stage is well set upon which to play one of the world's most fascinating stories – how the human being lives and dies.

CHAPTER 23

The Standardization of Recording

DURING the past two decades considerable advances have been made in the standardization of recording. Five of the main considerations are dealt with here:

1. Certification of cause of death.
2. Standardization of diseases, injuries, and causes of death.
3. Practice and procedure in registration.
4. Classification by occupation and industry.
5. Classification by social class.

1. CERTIFICATION OF CAUSE OF DEATH

The International Death Certificate

In countries where medical certification is possible – either in whole or in part – there is need for uniformity, both in completion of the death certificate and in its interpretation. Particular difficulties have arisen from an increasing tendency to enter more than one cause, together with a diversity of systems of arbitrary rules by which the primary or underlying cause has been selected for statistical use. Certificates stating only a single condition seldom present difficulties. Such certificates, however, form a diminishing proportion of the total, owing to various factors, or a combination of them: such as the rapidly decreasing incidence and fatality in many countries of acute infectious disease, the rising average age at death, and the increasing proportion of deaths from multiple chronic conditions. In 1928, a certificate, almost identical with the form introduced in England and Wales in 1927, was recommended for international use by the Cairo Commission of the International Statistical Institute. The purpose of this was to make it possible to select *the underlying cause* of death without resort to arbitrary rules of selection. In 1948, the 6th Decennial International Revision Conference designed the following certificate for general use (again confirmed by the World Health Assembly, 1967).

INTERNATIONAL FORM OF MEDICAL CERTIFICATE OF CAUSE OF DEATH

CAUSE OF DEATH		Approximate interval between onset and death
I		
Disease or condition directly leading to death*	(a) .... due to (or as a consequence of)	....
Antecedent causes	(b) .... due to (or as a consequence of)	....
Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last	(c)	....
II		
Other significant conditions contributing to the death, but not related to the disease or condition causing it	....	....
	....	....

Where several conditions are present at death, the classification of cause now largely depends upon the order in which the certifier enters them on the certificate. The *underlying cause* of death, which appears on line (c) is

(a) the disease or injury which initiated the train of morbid events leading directly to death,

or

(b) the circumstances of the accident or violence which produced the fatal injury.

The instruction to physicians on the use of the international form points out that the responsibility for indicating the course of events now rests upon the certifier:

* This does not mean the mode of dying, for example, heart failure, asthenia, etc. It means the disease, injury, or complication which caused death.

Since he is in a better position than anyone else to decide which condition leads directly to death and what antecedent conditions, if any, gave rise to the direct cause. It is a new principle in mortality statistics that they shall represent, as nearly as possible, the opinion of the doctor who knew or saw the patient as to what was the underlying cause of death; previously, automatic precedence of one condition over another was often given regardless of the sequence in which they were recorded on the death certificate.[41]

The importance of this homily can be judged from Logan's statement that it was not until 1940, thirteen years after the introduction of the form, that 'certifiers were using the form carefully enough for the order of the statement to be used to select the underlying cause of death for tabulation, in preference to the old system of selection by rules'.[36]

Difficulties of Continuity

The introduction of the international certificate has created its own problems of how to maintain continuity in subsequent years, when diseases have been displaced from positions of priority which they have held under rules of precedence. As an example, all systems of rules of precedence, dating back to pre-insulin days, gave preference to diabetes, then often fatal, over most conditions, except acute infections, cancer, and violent causes. Since diabetes has ceased, except in a few instances, to be considered as the underlying cause of death, the effect of the change in the certificate on the incidence of diabetes as a cause of death has been considerable. Thus, immediately after the change in Canada, in 1949, deaths attributed to diabetes were reduced by 45 per cent. It is important, in countries where such sudden artificial changes take place in morbidity rates, that the appropriate adjustment should be made in past statistics to enable a continuous and comparable picture to be presented. Many other difficulties of continuity result from the refining process of international standardization, for example, those which arise from adjustment in definitions, as with foetal death and stillbirth (see p. 238), or alterations in denominators and numerators, as has occurred in maternal mortality. It is one of the tasks of the WHO centre of classification of disease to advise nations about them.

Instruction to Doctors in Certification

Despite the use of the international form of death certification, ambiguity, vagueness, and other faults in its completion still complicate the preparations of mortality statistics. In the U.S.A. in 1954 perhaps 20 per cent of the medical returns were not properly made (Moriyama). Doubt, for example, may arise from the

physician's failure to specify clearly the underlying cause – as where death has been certified as due to 'diabetes due to chronic rheumatic endocarditis' – two unrelated conditions. This particular difficulty, which affects all countries in the world without exception, can only be met through the education of doctors. The booklet *Medical Certification of Cause of Death: instructions for physicians in the use of the international form of medical certificate of cause of death* is recommended for use in medical schools.[41] This should enable medical students and newly qualified practitioners to understand that the death return is a valuable document.

It is, however, to established practitioners that we must look if more immediate improvements in the quality of mortality statistics are to be achieved. One means to this end is the inclusion of 'explanatory notes and suggestions to practitioners' in the issues of books of forms, so that a medical practitioner called upon to give a death certificate always has at hand some written guidance. In England and Wales books of forms also include an alphabetical list of undesirable terms, with a note of the further information which should be supplied and a number of examples of how the form should be used.

There are many other ways of approaching the established practitioner, as through the medical journals, society meetings, and refresher courses. The experience of England and Wales teaches one particular lesson:

> That a large improvement in certification cannot be expected from a one-time application of a single method of instruction or propaganda. What is needed is the long continued application of many methods. Doctors in clinical practice are always ready to co-operate gladly with official requirements when they are satisfied that what is required of them really serves a useful purpose. Every opportunity must therefore be seized to remind them that a useful purpose is served by giving proper medical certificates of cause of death, and to explain to them clearly what is wanted of them.[36]

Much depends on doctors' attitudes, understanding, and beliefs. Moriyama[44] conducted a survey by personal interviews seeking the answer to such questions as 'What do you consider to be the value of certification?', 'What are the uses of death certificates?', 'Do you believe in the value of such procedures?' The answers to such questions give a better insight into the root causes of present inadequacies, and this method might be used with advantage in other countries.

An effective means of educating the doctor is through a system of personal inquiry from the central statistical organization. Such inquiries are probably general throughout the Western world;

approximately three per cent of forms are queried in this way in the United States of America and two per cent in England and Wales (10,000 inquiries to practitioners are sent annually by the Registrar General). Although such inquiries are more readily conducted in countries of type A with well-developed medical services, they should be begun everywhere as soon as possible. The doctor should realize that somebody does scrutinize closely, from the medical standpoint, what he writes on his certificates. As an elaboration of this method an attempt should be made to single out cases of doctors who persistently return defective forms; these can then be interviewed in their own homes. In these ways constant effort can result in more or less uniform procedures being followed by individual certifiers.

Even under ideal conditions, however, the death certificate can do no more than register the physician's knowledge and medical opinion regarding causes of death – this will always be so whatever medical progress takes place. But in interpreting statistics derived from these reports it is important to know about reliability. For this the only means is to sample death certificates, and to check the diagnoses by going through hospital and autopsy records and interviewing the certifying physician.

Non-medical Certification of Death

The certification of cause of death presents difficulties everywhere, but these are greater in territories where there are few doctors – i.e., for large parts of the world including most, if not all, areas that do not reply to the United Nations questionnaires (see p. 221). In Chile, for example, 'a considerable proportion of diagnoses on death certificates are made by physicians who have not treated the patients . . . or even worse by witnesses; there are usually no facilities for examination, and even diagnoses by physicians are likely to be inexact and unverified.'[57] Indonesia may be taken as fairly representative of under-developed countries in this respect. In 1957 it had approximately one doctor to 57,000 people; there is little medical certification outside the large towns, and not much in these. Indonesia had a system of counting births and deaths, using the headmen of the villages, from the end of the nineteenth century. The death form was introduced in 1935 and had been extended over 13 regencies by the end of 1938, when the war, and later revolution, brought registration to a halt until 1950. In the towns of Java, with fair municipal services, special certifying officers have been appointed, working from the health department,

to visit all cases where there is no doctor's certificate. Thus, in Bandung, with a population of 802,105 in 1954, there were 16 certifying officers working under the direction of the medical officer of health.* The number of deaths, 447, recorded in the year 1955 gave a low crude death rate of 11·17. Deaths were arranged under 37 causes, less than the 'abbreviated list of 50 causes for tabulation of mortality' which is the smallest to be prescribed by the *Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death* (1948) (see Appendix 2). The shortness of the list need not detract from its value providing the individual items clearly state the code numbers of which they are composed.

In rural areas of many countries the compilation of statistics is done by the headmen of the villages, who should receive special instruction from the health department. The village clerk acting for the headman should seek answers to a small number of pertinent questions: (1) Was the patient ill for several days or for months? (2) Had he fever? (3) Had he diarrhoea? (4) Had he cough with haemoptysis? (5) Did he die because he was old? (6) Did he die because of accident or murder? In the case of children: (7) Had the child fever and/or convulsions? (8) Had the child oedema? In the case of a young or middle-aged woman: (9) Was it a maternal death? In Java the residency health doctor employs four persons in checking the resultant statistics.

Nothing like a true picture of deaths can be obtained in such circumstances, over the greater part of areas A and B, but the results of such simple procedures are by no means negligible. Although careful computing cannot give validity to data which never had any in the beginning, lay recording under skilled direction is certainly of value. We should bear in mind John Graunt's words, when he wrote of the London Bills of Mortality (1662):

> As for consumptions, if the searchers do but truly report (as they may) whether the dead corps were very lean and worn away, it matters not to many of our purposes, whether the disease were exactly the same as physicians define it in their books.

2. STANDARDIZATION OF NOMENCLATURE OF DISEASES, INJURIES, AND CAUSES OF DEATH

(i) *The History of International Standardization*

From the earliest time much of the difficulty in producing worthwhile statistics of mortality and morbidity has been rooted in the

* Personal communication from Raden Admiral Surasetja, Health Officer, 1957.

lack of scientific accuracy in disease classification. William Farr, in his first annual report of the Registrar General in 1839, says:

> The advantages of a uniform statistical nomenclature, however imperfect, are so obvious, that it is surprising no attention has been paid to its enforcement in bills of mortality.

International collaboration in this matter, at least among European nations, began with the First International Statistical Congress held at Brussels in 1853, when William Farr and Marc d'Espine were instructed to prepare '*une nomenclature uniforme*'. The general arrangement of this early list, based upon anatomical sites, has survived to this present time. The Bertillon classification followed the Vienna Congress of 1891. The First International Conference for the Revision of the International Classification of Causes of Death was held in Paris in August 1900. Delegates from 26 countries attended. The government of France called successive conferences in 1909, 1920, 1929, 1938, 1948, and 1955.

(ii) *The Sixth Revision*

After the Second World War the initiative fell to WHO, which undertook most of the work for the International Conference for the sixth Revision of the International Lists of Diseases and Causes of Death, convened by the French government in 1948. The Conference, which was attended by 29 countries,* recommended the World Health Assembly to adopt the *Sixth Revision of the International Statistical Classification of Disease, Injuries, and Causes of Death,*[38] which had largely been the work of an Expert Committee under the chairmanship of Percy Stocks, Chief Statistician to the General Register Officer of England and Wales.†

During all this time there had been no common classification for causes of disease and death, from which so obviously the greatest advantage could come. Farr early recognized this and put forward a proposition 'to extend the same system of nomenclature to disease which, though not fatal, caused disability in the population . . .' In 1860, Florence Nightingale had also urged hospitals to adopt Farr's classification of causes of death, so that 'the laws which regulate diseased action would become better known' (see also p. 262).[48] As the classification became more complicated the achievement of this

* Belgium, Bulgaria, Canada, Chile, Cuba, Czechoslovakia, Denmark, Ecuador, Ethiopia, France, Greece, Guatemala, Hungary, Iceland, India, Ireland, Italy, Luxemburg, Mexico, Netherlands, Norway, Poland, Portugal, Siam, Sweden, Switzerland, United Kingdom, United States of America, and Venezuela.

† This was set up by the Interim Commission of WHO (1946).

ideal became increasingly difficult. Apart, therefore, from the advantages of its world-wide extension, the new classification had achieved the hitherto unattainable ideal of fusing the codes of mortality and morbidity which had so long been sought. It has been followed by the Seventh and Eighth* Revisions (1955 and 1966).

(iii) *Simplified Forms of Tabulation*

Further tabulations (see Appendices 1, 2, 3, 4, 5) (1967) provide for special purposes: List A – 'List of 150 causes for tabulation of morbidity and mortality'; List B – 'List of 50 causes for tabulation of mortality'; List C – 'List of 70 causes for tabulation of morbidity'; List D – 'List of 300 causes for tabulation of hospital morbidity'; List P – 'List of 100 causes for tabulation of perinatal morbidity and Mortality'. Further abbreviations or expansions can be made to meet particular needs by varying the aggregation of the international code numbers. An unofficial list of 51 causes, resulting from an African Seminar, provides for non-medical certifiers (Appendix 6).

(iv) *The WHO Centre for Classification of Disease*

The new rules gave rise to many problems of interpretation. As more and more countries started to use the classification, it became obvious that advice centres were needed for guidance on current problems. Such centres could also be charged with the continual study of the international list – for inconsistencies and inaccuracies, as well as of the means to collect, record, and tabulate data, and of the recurrent problems affecting comparability. Centres have been established in London (1951), Caracas (1955) and Moscow (1967). The results of correspondence and consultation with those concerned with the international classification, in national offices and elsewhere, are incorporated in pamphlets, which should be freely consulted: (1) The Instructions to physicians already mentioned;[41] (2) Amplification of Medical Certification of Cause of Death. Inquiries to certifiers concerning incomplete or vague statements.[1]

(v) *The Training of Coders*

In developed countries particularly, and elsewhere throughout the world, when the International Statistical Classification of Diseases, Injuries, and Causes of Death comes into use for mortality and

* *The Manual of International Statistical Classification of Diseases, Injuries and Causes of Death* is now available in English, French, Spanish, Latin, German, Italian, Japanese, Greek, and Russian.

morbidity, there arises the need to train 'coders' for tabulation of data. To lay people unacquainted with medical terminology, ignorant of the structure and physiology of the body, and prejudiced by private theories and popular superstitions, the study of the international classification can be an exacting task, but one which leads to satisfaction in work and a surprising accuracy of application. Experience arising out of recent developments in the sickness surveys, schemes for cancer registration, and those for hospital statistics, has shown that it is necessary to give instruction in the coding process to records officers in hospital, statistical staff in government and public health departments, and in the central statistical office.

Courses for coders have been held in London, in Geneva, in the British West Indies, in Caracas, and in Santiago, Chile; a similar course for medical records officers was held in Bangkok (1965). The general arrangement, as illustrated by those run by the General Register Office in London, is a course of one week of which two days are devoted to lectures and discussions and the remainder of the week to coding instructions covering the following main points: (1) the significance of the beginnings and endings of medical terms, (2) the names of the principal bones, (3) the layout of the classification, (4) the descriptive arrangement of the notes of exceptions and conventions for colons and brackets, (5) undesirable terms, (6) the use of code numbers which vary according to circumstances.

3. PRACTICE AND PROCEDURE IN REGISTRATION

When the details of births and deaths have been properly entered in the appropriate certificates, there remains the risk of inaccuracy and inconsistencies arising out of unsuitable practices and procedures in registration. The machinery for marketing the data has still to be attended to. Moreover, comparability as between nations can only be achieved by the adoption of uniform systems. The means to this end – complicated by the unequal development throughout the countries of the world – have been set out in 'Principles for a Vital Statistics System' produced by the Statistical Commission of the Economic and Social Council (1953).[50]

The functions of the Statistical Commission, as set forth in its terms of reference (21 June 1946), included that of 'promoting the development of national statistics and the improvement of their comparability'. At its fourth session in 1949 it began the consideration of vital statistics. The Commissioners worked on the basis that

almost every sovereign country, whatever its stage of development, and almost every non-sovereign country, at least in parts, has long-established registration systems, either ecclesiastical or civil; but that all, or most, lack both the effective practices for linking the various parts together, and the procedures for developing vital statistics from a registration system.

One of the main concerns of this guide is to ensure a direct relationship between vital statistics and health statistics through the use of the same area, definitions, and classifications. It is equally necessary for the authority responsible for vital statistics to be in close working partnership with those responsible for the census. The principles, which were commented upon in draft by 58 governments – no doubt those that replied to the annual questionnaire previously referred to – are in four parts: (i) General (107–109); (ii) Legal Registration (207–216); (iii) Recording, Reporting, and Collecting Data (307–309); (iv) Compilation (407–412).

(i) *General Principles*

General principle No. 101 defines a vital statistics system as 'including the Legal Registration, Statistical Recording, and Reporting of the occurrence of, and the collection, compilation, analysis, presentation, and distribution of statistics pertaining to, "Vital Events" '.[50]

Among the other General Principles discussed are a need for 'confidentiality', for a clear designation of responsibilities, for critical appraisal, and for the use of sampling and surveys in obtaining statistical data (see Chapters 25 and 26).

(ii) *Legal Registration*

The principles involved in Legal Registration relate mainly to priorities, definition, and the machinery of Registration itself. Registration according to the Principles should be compulsory, however inefficient (203). This insistence on legal compulsion, when the social structure is insufficient to support it, is perhaps somewhat surprising in view of the many doubts which have been expressed on this score (see p. 303). There should be a national office with authority where possible over local centres of registration (206). The office of Registrar, nationally and locally, should be clearly defined (207); likewise the responsibilities of informants (209), the time allowances (216), and the form and content of registers (215).

Priority in registration should be given to births and deaths and foetal death; marriages and divorces should be registered as facilities

provide; adoption, legitimizations, etc., represent an ultimate objective. Registration of all foetal deaths irrespective of the period of gestation is a desirable goal, in spite of deficiencies in the criteria for abortion, to be attained as soon as possible. In the meantime, as a minimum 'all countries should register all foetal deaths occurring after the twenty-eighth computed week of gestation'. These are late foetal deaths or stillbirths (see p. 240).

All live-born infants should be registered, and counted as such, irrespective of the period of gestation, or whether alive or dead at time of registration; and if they die at any time following birth they should also be registered and counted as dead.

The following definitions are given for live birth, death, foetal death, and stillbirth:

1. *Live birth* is the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy, which, after such separation, breathes or shows any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached; each product of such birth is considered live born.
2. *Death* is a permanent disappearance of all evidence of life at any time after live birth has taken place (post-natal cessation of vital functions without capability of resuscitation). This definition therefore excludes foetal deaths.
3. *Foetal death* is death prior to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy; the death is indicated by the fact that after such separation the foetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles.

A definition of early, intermediate, and late foetal death in terms of duration of gestation was given by the 2nd Session of the Expert Committee on Vital Statistics: early – less than twenty completed weeks of gestation; intermediate – twenty completed weeks, but less than twenty-eight; late – twenty-eight weeks of gestation and over.[80]

The length of gestation should be measured from the beginning of the last menstruation.[80] No recommendations are made, however, for computing this period where the date of the last menstrual period is not known – a problem which arises not infrequently where calendars, etc., are not available. Some more precise international measurement, by length or weight of foetus or size of fundus, might be an advantage.*

The term stillbirth, now synonymous with late foetal death, is retained because its abandonment might 'cause confusion or impair

* For stillbirths, Austria, Sweden, and the Federal Republic of Germany specify a minimum of 35 centimetres; Switzerland over 30 centimetres; and Czechoslovakia over 400 grammes.

the present clear distinction in recording and compiling statistics of live births and deaths'. However, its varying significance in terms of viability (see p. 238) should be eliminated by parallel records which indicate the numbers of stillbirths that fall into the three periods of foetal life (early, intermediate, and late).

(iii) *Recording, Reporting, and Collecting Data*

The Statistical Reports should, as far as possible, tabulate the same items and use the same definitions. Part 3, therefore, gives, among other things, detailed recommendations for the items to be recorded and defines each of the 29 such items, for example, age, attendant at birth, birth order, cause of death, certifier, date of death, etc. (Principle 309 should be consulted for a full list of definitions.)

The content of Statistical Reports recommended by the United Nations is as follows[50] (items are arranged in alphabetical order by event and participants, with an indication of first (¶) and second priority rating, i.e., for their statistical importance):

A. *Live Birth Statistical Report Items*

Characteristics of the event or child
- ¶Attendant at birth
- ¶Date of occurrence
- ¶Date of registration
- Hospitalization
- ¶Legitimacy
- Period of gestation
- ¶Place of occurrence
- ¶Sex
- ¶Type of birth (single or plural issue)
- Weight of birth

Characteristics of parents
- Date of birth of father; if not available, age
- ¶Date of birth of mother; if not available, age
- Date of marriage (for legitimate births)
- Industry
- Literacy or level of formal education
- ¶Number of children born to this mother
- Occupation
- Place of usual residence (of mother)
- Status (as employer, employee, etc.)

B. *Death Statistical Report Forms*

Characteristics of event
- ¶Cause of death
- ¶Certifier
- ¶Date of occurrence
- ¶Date of registration
- ¶Place of occurrence

Characteristics of decedent
- Age of surviving spouse (if married)
- ¶Date of birth; if not available, age
- Hospitalization
- Industry
- Legitimacy (for under one year of age)
- Literacy or level of formal education
- Marital status
- Number of children born (for females of child-bearing age or over)
- Occupation
- ¶Place of usual residence
- ¶Sex
- Status (as employer, employee, etc.)

C. *Foetal Death Statistical Report Items*

Characteristics of event or product
- Cause of foetal death
- Certifier or attendant
- ¶Date of occurrence (of foetal delivery)
- ¶Date of registration
- Hospitalization
- ¶Legitimacy
- ¶Period of gestation
- ¶Place of occurrence
- ¶Sex
- ¶Type of birth, i.e. single or plural issue
- Weight at delivery

Characteristics of parents
- Date of birth of father; if not available, age
- ¶Date of birth of mother; if not available, age
- Date of marriage (for legitimate pregnancies)
- Industry
- Literacy or level of formal education
- ¶Number of children born to this mother
- Occupation
- ¶Place of usual residence (of mother)
- Status (as employer, employee, etc.)

The minimum record for foetal death certificates should be (1) cause of death, and (2) number of weeks of gestation; but for those countries which can secure additional data, whether on the registration certificate or by special inquiry from physicians or others, the following information should be obtained:

A. Conditions which you believe may have contributed to the death of the foetus.
   1. General health of the mother
   2. Conditions of pregnancy and labour
   3. Conditions of foetus, placenta, and cord.

B. Foetal autopsy performed: yes or no.
   Causes found at autopsy.

C. Cause of foetal death in your opinion.

D. Additional data:
   1. Duration of pregnancy (in weeks)
   2. Birth weight
   3. Time of death:
      before labour: yes or no.
      during labour: yes or no
      uncertain
   4. (a) Normal labour: yes or no
      (b) Manipulative, instrumental, or other operative procedure for delivery (give details).

(For the records necessary for other vital events see p. 217.)

(iv) *Compilation*

Compiling vital statistics into tables is the means by which the significance of registration data can be examined. This is the means to study incidence, time trends, geographical variations, and their interrelationships. How much of this can be done will depend on the completeness of registration, upon staff and counting machinery, and all the other considerations which are discussed elsewhere in this chapter. (See also handling of data and tabulation, Chapter 29.) There are immense possibilities which increase with the improvement in detailed recording (see p. 239); and particularly when data are studied in relation to social class, occupation, industry (see pp. 243–252), and through other characteristics, ethnic, religious, and otherwise. It is, of course, a mistake to try to run before being able to walk. But every nation should set its sights high and should seek to perfect the recording, reporting, and collecting of data, so that compilation can be scientifically undertaken.

As the statistics of the British Registrar General have shown over the past 120 years, imaginative tabulation of data can be immensely rewarding. But in the circumstances where every nation's needs are so different and their capacity so varying, it is hardly possible to state precisely what an annual programme of tabulation should seek to do. Every country must examine its own possibilities, bearing in mind that the presentation of results is of value for international as well as national purposes. International comparisons can, of course, be helpful to individual nations as a pointer to national weaknesses. Comparability, above all else, must be obtained. Principle 401 gives as the minimum goal:

> The provision of total monthly or quarterly summary counts of live births and deaths (and of foetal deaths, marriages, and divorces if these are included in the collection programme) on a time schedule prompt enough to provide information for administrative needs; and the production of detailed annual tabulations of such type and on such time schedule as will make possible their effective use for the scientific analysis of the interrelationship between demographic, economic, and social factors, for planning, operating, and evaluating public health programmes, and for other purposes as required. In so far as possible, such statistics should be comparable on an international basis and lend themselves to international analysis.[50]

The area of complete tabulation should be the whole country. Where this is impossible, complete tabulation should be secured for as many local areas as possible, with restricted tabulation from as much of the remaining territory as possible (402). The whole population should as far as possible be covered with separate tabulations for important groups which either cannot be registered completely, or are for other reasons outstanding (403). The compilation of statistics should be centralized (404, 405). Tabulation should be by Gregorian calendar periods (407), by date of occurrence rather than by date of registration (408) and, for the purpose of local statistics, by place of usual residence, i.e., of mother for births and infant deaths, and of deceased for deaths.

Generally speaking, data need to be tabulated for (1) the country as a whole, (2) each major civil division, and (3) every important city. In terms of the few priority items distinguished by ¶ (see p. 239) the following tables can with advantage be prepared:

> For deaths: by place of occurrence; by age, sex, and cause; by type of certification and cause; and, for selected diseases which are important as leading causes of death or which have significant seasonal variations, by month of occurrence. In the case of infant deaths tables should be prepared for: place of occurrence; place of residence of mother; age cross-classified with month of occurrence; sex cross-classified with age; and by cause of death. Foetal deaths should be tabulated by: place of occurrence; sex and

period of gestation, and late foetal deaths (or stillbirths) also by sex and legitimacy; and by age of mother cross-classified with total birth order.

For live births: by place of occurrence; by attendant at birth; by month of occurrence; by sex cross-classified with legitimacy; and by age of mother cross-classified with live birth order. Confinement can usually be tabulated according to type of birth (single, twin, etc.) cross-classified with state of issue (born alive or dead).

The procedure of tabulating mortality is also set out in WHO Regulations I – 'Regulations regarding nomenclature with respect to diseases and causes of death (1948, amended 1967).'[79]

Countries have been slow to modernise, and even slower to inaugurate de novo, systems of collecting vital data; but steady improvement has taken place using the *Principles for a Vital Statistics System*. They have been the subject of discussion in training centres, national committees, and international conferences as, for example, in the United Nations International Seminar on Statistical Organization held in Ottawa, Canada, in which twenty-six countries participated, and the WHO Expert Committee on Health Statistics. They are also used by consultants in statistics working in various countries, and are available for schools of public health.

4. CLASSIFICATION BY OCCUPATION AND INDUSTRY

'If men knew the people', John Graunt said in 1662,

it would appear, how small a part of the people work upon necessary labours and callings, viz. how many women and children do just nothing, only learning to spend what others get; how many are mere voluptuaries, and as it were mere gamesters by trade; how many live by puzzling poor people with unintelligible notions in diversity and philosophy; how many by persuading credulous, delicate, and litigious persons, that their bodies or estates are out of tune, and in danger; how many by fighting as soldiers; how many by ministries of vice and sin; how many by trades of meer pleasure, or ornaments; and how many in a way of lazy attendance, etc. upon others; and on the other side, how few are employed in raising and working necessary food and covering; and of the speculative men, how few do study nature and things! the more ingenious not advancing much further than to write and speak wittily about these matters.

He added:

I conclude that a clear knowledge of all these particulars, and many more whereat I have shot but at rovers, is necessary, in order to good, certain, and easy government. . . . But whether the knowledge thereof be necessary to many, or fit for others than the sovereign and his chief ministers, I leave to consideration.

Studies of mortality, morbidity, fertility, and other surveys which seek to discover the way in which the community is living, can be greatly enriched – as the International Labour Office has emphasized[51] – by relating findings to the work in which people engage. The nature of the work, wherever it is performed, must contribute a major part of the strains to which men and women are subjected. Physically and mentally they are involved in the whirligig of working life. Men and women at work may be classified for statistical purposes in two ways: by occupation or by industry.

(i) *Industrial Classification*

For industrial classification, *'the industry in which any individual is engaged is determined, whatever his occupation, by reference to the business or economic activity in, or for the purposes of which, his occupation is followed'*.[5] Much may be dependent on the industry in which the work takes place, but much may not – the grouping of individuals together, whatever their occupation, is of importance in itself, particularly from the economic standpoint. But there are other reasons; it is a very different thing to labour in the fields than at the steel furnaces. Classification is based strictly upon the nature of the product, or, in the case of non-manufacturing industries, on the type of service rendered. No consideration of personal occupation enters into it.

The International Standards Industrial Classification[31] distinguishes:

- Agriculture, forestry, hunting, and fishing
- Mining and quarrying
- Manufacturing
- Construction
- Electricity, gas, water, and sanitary services
- Commerce
- Transport, storage, and communication
- Services
- Activities not adequately described.

These divisions are subdivided into 'major groups' and 'groups'. Indices to the groups are *numeric*, containing approximately 10,000 entries, and *alphabetic*, consisting of 17,000 entries. These ensure uniform interpretation.

(ii) *Occupational Classification*

Occupational standardization *distinguishes groups of people for which the basic common factor is the kind of work done.* Industry may contain many separate and distinct occupations – upon which the nature of the factory, business, or service, in which the work is done has no bearing. Clerks may work in any industry; navvies in a great variety of different undertakings from building to metal manufacture; a crane driver may work in a shipyard, an engineering works, or in building. Where the kind of work is too comprehensive – since it may include too great variations in skill, in physical energy, in environmental or in economic status, or in any combination of these – further subdivisions have to be made, to identify what are substantially separate occupations. The groups must, in any event, be large enough to justify separate enumeration, and they must be distinct in themselves and not dependent upon a parallel classification of industry.

The International Standard Classification of Occupations (see Appendix VIII) has 9 major groups, 77 minor groups, and 283 unit groups, covering about 1,700 occupations.[30 51] This classification, the result of ten years' work by ILO, appeared first in 1958 and was put to its first major test in the various national censuses held around 1960. For international comparisons of occupational mortalities and social class classifications based upon it, we may yet have to wait some years.

5. CLASSIFICATION BY SOCIAL CLASS

Mortality, morbidity, and the use made of various services, can also be examined in relation to social stratification – a *prestige rating,* the grouping of people together in terms of the value which society places upon them. Any scale of values of this character must be arbitrary and is not likely to be universally accepted. But there is sufficient agreement to make measurement by social stratification a useful statistical tool. Many methods of devising such a scale have been evolved by social scientists, social anthropologists, doctors, and others – although not yet (1968) at the international level. For the particular purpose of vital and health statistics we need to examine three only, two American and one British.

(i) *Evaluation Participation*[77]

A method of placing individuals in one of the six classes by means of *interviews and observation.* What the individual says and how

he acts provides the evidence for the class divisions, recognized by a particular community; it also reveals the place in these divisions which any individual considers himself and others to occupy. The final rating is obtained by matching the results of many interviews and taking the measure of greatest agreement. This research method can be used to check other methods; but it is costly and time-consuming, and can have no real place in the day-to-day work of public health.

(ii) *Index of Status Characteristics*[77, 78]

A system of point valuation allots marks to the four chief characteristics which distinguish a man in the eyes of his associates: (a) occupation, (b) source of income, (c) house type, and (d) dwelling area. Warner says:[77]

> For an accurate index of social class, each of the four characteristics and the points in their scales must reflect how Americans feel and think about the relative worth of each job, the sources of income which support them, and the evaluation of their houses and the neighbourhoods in which they live. For it is not the house, or the job, or the income, or the neighbourhood that is being measured so much as the evaluations that are in the backs of all your heads – evaluations placed there by our cultural tradition and our society. From one point of view the four characteristics, house, occupation, income, and neighbourhood, are no more than evaluated symbols which are signs of status, telling us the class levels of those who possess the symbols. By measuring the symbols, we measure the relative worth of each; and by adding up their several 'worths', reflecting diverse and complex economic and social values, we get a score which tells us what we think and feel about the worth of a man's social participation, meaning essentially that we are measuring his Evaluated Participation or social class.

Each characteristic is subdivided into seven grades. The seven grades of income range from inherited wealth, which scores 1, to public relief or non-respectable income, which scores 7; housing from large houses in excellent condition scoring 1 to houses in very bad condition scoring 7; the dwelling area from 'superior region' to the 'lowest slum'; and occupation from 'high professional and proprietors of large businesses' to unskilled workers. A multiplying factor takes into account the varying importance of house, income, dwelling area, and occupation. Occupation is rated at 4, income and house at 3, and dwelling area 2. Thus the topmost score in this scale is 12; 4 for occupation, 3 each for income and house, and 2 for dwelling area; the lowest score is 84 (28, 21, 21, 14). A certain clerk (Mr Jones) with a salary, living in an average-sized house in average condition, in a residential neighbourhood which is beginning to deteriorate scored:

	Rating		Weight	Score
Occupation (clerk)	3	×	4	12
Source of income (salary)	4	×	3	12
House type (average)	4	×	3	12
Dwelling area (below average)	5	×	2	10
				46

Six classes are used by arbitrary divisions within the range 12–84. Thus the two upper classes extend from 12 to 22; upper middle is 23–37; lower middle is 38–53; upper lower is 54–66; lower lower is 67–84. Mr Jones is rated as lower middle class.

(iii) *Social Class by Occupation*

The British social class grading uses the distinctions which arise out of working conditions alone. This arbitrary grouping dates back in substance to that of Dr T. H. C. Stevenson, the Chief Medical Statistical Officer, first produced in 1911 – consisting of five classes: (a) Professional, etc., occupations, (b) Intermediate occupations, (c) Skilled occupations, (d) Partly skilled occupations, and (e) Unskilled occupations. Its basis is the general standing of each occupational group within the community, economic circumstances not being taken into account, except in so far as they are reflected in occupation. The broad structure of the five social classes is as follows: *

1. *Professional, etc.*
   (a) Professional engineering, surveying, and architecture
   (b) The medical profession
   (c) The legal profession
   (d) Scientists
   (e) Ministers of all churches
   (f) Officers of all the armed forces
   (g) Literature
   (h) Directors of business
   (These are higher administrative and professional occupations and business directorships.)

2. *Intermediate*
   (a) Managing Directors and employers of business
   (b) Various professional persons and officials

* For the details of the British Social Class grading see Census 1951 Classification of Occupations, 1956, with amendments in Classification of Occupations 1960, H.M.S.O., London; also Brockington, *The Health of the Community*, Appendix, 'Social Stratification', Churchill, London, 1965, 325–334.

(c) Teachers
(d) Clerks (costing, estimating, and accounting only)
(e) Hotel and restaurant keepers
(f) Farmers
(g) Medical auxiliaries
(h) Proprietors and managers of wholesale and retail businesses

(These are persons responsible for initiating policy and others without this responsibility but some responsibility over others.)

3. *Skilled*

(a) Clerical workers
(b) Shop Assistants
(c) Personal service
(d) Foreman, superintending staff, and inspectors
(e) Skilled workers in:
  (i) transport and communications
  (ii) minor professional and technical occupations
  (iii) civilian defence
  (iv) armed forces (other ranks)
  (v) entertainment and sport
  (vi) wood and cane
  (vii) bricks
  (viii) glass
  (ix) coal
  (x) chemical and allied trades
  (xi) metal manufacture and engineering
  (xii) textiles
  (xiii) tanning, leather goods, fur dressing
  (xiv) makers of textile goods and articles of dress
  (xv) makers of foods, drink, and tobacco
  (xvi) paper, printers, and bookbinders
  (xvii) rubber, plastics, and musical instruments
  (xviii) building, contracting, painters, decorators
  (xix) agricultural craftsmen

(These are skilled workers with a special name, special responsibility and adaptability.)

4. *Partly skilled, i.e. workers on or in:*

(a) Agriculture
(b) Mines
(c) Metal industries

(d) Textiles
(e) Transport
(f) In service
(g) Various semi-skilled occupations
(These are semi-skilled or persons who are doing manual work which needs no great skill or training, but who are doing it habitually and in association with a particular industry.)

5. *Unskilled*
(a) Labourers
(b) Cleaners
(c) Other lowly occupations
(The use of the word unskilled does not of course mean lack of all skill.)

The reliability of a social classification based upon occupation has been examined in a study in which 138 occupations were separated into 9 groups.[24] In 66 five judges differed no more than one grade and in 10 all agreed. A difference of 4 grades was observed for only six occupations; a difference of 3 for 19; of 2 for 37. In a further study, 30 occupations in 5 groups were graded by 74 members and friends of an Adult Education class. The median grading of the 74 returns compared closely with the standard. In 1,000 classifications obtained through representative organizations the average judgement of the general public differed from the standard classification (now in seven groups) in three instances only – farmer, coal hewer, and railway porter.

Thus occupations can be arranged in order of the social value ascribed to them in common acceptance, where the determining factors are the man's associates while at his job and their average standard. Yet no agreed scale could ever exist by which to rank all occupations. 'Farmers and farm labourers may agree on the social rating which each group affords the other. But such an agreement is far less likely to be reached by, for example, farmers and artists.'[19] In the U.S.A., it is said, people tend to class themselves as 'middle class' more frequently than in the judgement of independent observers. Some apparent discrepancies may represent no more than a difference in judgement as when the Registrar General placed actors and musicians (codes 835 and 836) originally within class 3, on the same level as stage hands (code 837), chimney sweeps (code 876), and bath and wash-house attendants and managers (code 871) (they were moved in 1960 from class 3 to class 2).[5 6] Other discrepancies arise from the handling of occupational groups as

units. Since each is assigned as a whole, there must often be individuals within the group for whom the resultant social class grading seems less appropriate. University teachers, including the Professors who are directors of University departments, are now better placed as professionals in class 1 than they were before 1960[6] as teachers within class 2. The main divergencies will be found in the central regions of the scale. Classes 1 and 5 are composed of individuals who would probably be assigned to the top and bottom of the social scale by almost any set of criteria. Bankers, company directors, and shipowners on the one hand, and street newspaper sellers and rag and bone sorters on the other, would, by common consent, appear at opposite ends of any scale.

The single criterion of occupation has many advantages in ease of handling; denominators can be obtained through the census and numerators through the returns from local registrars. Although no precise comparison has been made between the results of I.S.C. and the Registrar General's classification or the International Standard Classification of Occupations, it seems likely that the majority of individuals would find themselves in the same social class, whether their status was based on an 84 point rating, or upon a single judgement on occupation. Certainly Mr Jones, earlier quoted, would have been in class 3, in the British social class, on occupation alone (unless a book-keeping clerk prior to 1960 in class 2).[6]

Nevertheless,

> Although occupation may be a major determinant in social position (and, conversely, 'social position' a major determinant in the choice of occupation), it is by no means the only determinant, and no classification based solely upon that factor can be fully satisfactory. A more realistic result (bearing in mind the probable limitations) might be achieved by using education and occupation as double criteria; and when the next census is being planned the possibility of collecting, either for the whole population or by means of a sample, information on education and other criteria should be considered.[19]

The chief weakness of the social classification by occupation lies, not so much in the discrepancies of individual occupations – some are inescapable and, taking the broad view, insignificant – but in a five- or six-class social grading, which necessarily lumps together occupational groups of widely differing characteristics. Class 3, which includes skilled workmen, also contains the 'white collar' occupations; the shop assistants; and 'personal service'. Such a classification is often too broad for a detailed investigation of any one social factor.

Many expansions of the original social class grading can be made to meet the needs of particular countries. The five-class scale can be

expanded or contracted – like the abbreviations of the International Classification of Diseases, Injury, and Causes of Death – retaining the code groupings, so that the effects of social class in mortality and morbidity and allied studies can be compared.

In the U.K., general mortality was studied in Britain (R.G.) based upon the 1957 census by further dividing the social classes – 3 (into 5 subgroups) and 2 and 5 (into two subgroups each); infant mortality likewise (the Social Medicine research unit) by dividing into 18 subdivisions (classes 2 and 5 into 3 each, class 4 into 4 and class 3 into 6).

Standardization by Socio-economic grouping

Systems[3], seeking to group people whose social, cultural and recreational standards and behaviour are similar, but paying regard also to economic aspects, have been devised to provide a basis for studies of mortality, morbidity, etc. The Conference of European Statisticians (1959)[8] 16 socio-economic groups are as follows:—

(1) *Employers and managers in central and local government, industry, commerce, etc. – large establishments*

Persons who employ others or generally plan and supervise in non-agricultural enterprises employing 25 or more persons.

(2) *Employers and managers in industry, commerce, etc. – small establishments*

As in '(1)' but in establishments employing fewer than 25 persons.

(3) *Professional workers – self employed*

Self employed persons engaged in work normally requiring qualifications of university degree standard.

(4) *Professional workers – employees*

Employees engaged in work normally requiring qualifications of university degree standard.

(5) *Intermediate non-manual workers*

Employees, not exercising general planning or supervisory powers, engaged in non-manual occupations ancillary to the professions but not normally requiring qualifications of university degree standard; persons engaged in artistic work and not employing others thereat; and persons engaged in occupations otherwise included in Group (6) who have an additional and formal supervisory function.

(6) *Junior non-manual workers*

Employees, not exercising general planning or supervisory powers, engaged in clerical, sales and non-manual communications and security occupations, excluding those who have additional and formal supervisory functions.

(7) *Personal service workers*

Employees engaged in service occupations caring for food, drink, clothing and other personal needs.

(8) *Foremen and supervisors – manual*

Employees (other than managers) who formally and immediately supervise others engaged in manual occupations, whether or not themselves engaged in such occupations.

(9) *Skilled manual workers*

Employees engaged in manual occupations which require considerable and specific skills.

(10) *Semi-skilled manual workers*

Employees engaged in manual occupations which require slight but specific skills.

(11) *Unskilled manual workers*

Other employees engaged in manual occupations.

(12) *Own account workers (other than professional)*

Self employed persons engaged in any trade, personal service or manual occupation not normally requiring training of university degree standard and having no employees other than family workers.

(13) *Farmers – employers and managers*

Persons who own, rent or manage farms, market gardens or forests, employing people other than family workers in the work of the enterprise.

(14) *Farmers – own account*

Persons who own or rent farms, market gardens or forests and having no employees other than family workers.

(15) *Agricultural workers*

Employees engaged in tending crops, animals, game or forests, or operating agricultural or forestry machinery.

(16) *Members of armed forces*

CHAPTER 24

The Measurement of Morbidity

THE SIGNIFICANCE OF MORBIDITY STATISTICS

IF the object of providing measurements of disease is to help reduce the ills, cost, and waste thereby caused, morbidity can supplement, and in some respects do more than, mortality statistics. They tell

the story of the many diseases which do not lead to death, and yet produce immense suffering and economic loss. They tell us whether decline in mortality is due to change in frequency of a disease, or simply to a change in its outcome. They can be related more closely to the social conditions which cause disease and which may be at work long before death takes place.

They can help to detect new hazards early, such as thalidomide malformations; they can indicate changes in the frequency of diseases calling for special care, or in the relative proportions of preventable diseases and diseases calling for treatment; they help in the identification of cause, factors affecting incidence and natural history, and presymptomatic features; they show the strengths and weaknesses of preventive and therapeutic measures in diseases both acute and chronic.

They do more than mortality data to indicate where better facilities are needed and what administrative adjustments are necessary, particularly in the organized health services, which nations are now beginning to develop. In comparison with mortality we are surprisingly ignorant of essential details about the distribution of disease, and in consequence, of the services which are needed to handle it. We need to know about those who go to hospital and of those treated by general practitioners; about the illnesses that people have or think they have which do not take them to a doctor; and about absences from work and school; why the work done in different institutions differs; why some hospitals deal with more patients than others. We must know about the sickness resulting from cancer, and of course much else.

The development of recording systems, for illness at home, in hospitals, at work, and through general practice, is not an easy task; but it is one of the most important now facing the world. This will help in the special studies of particular problems *relevant to the circumstances of each country* which, as emphasized elsewhere, are so necessary.

THE DEFINITION OF ILLNESS

In contrast with death, a clearly defined event, illness is difficult to define. It may wax and wane; its manifestations may be indefinite or even subjective; it may endure for periods of varying length; and it may be repeated. The terms which are used to describe it are many and varied; for example, sickness, illness, disease, injury, defect, impairment, handicap, complaint, morbid condition. Other terms in common use describe the particular episode rather than the illness

itself, for example, new, old, recurrent, sub-clinical, latent, manifest, continued, pre-existing, acute, chronic, relapse. Still others describe the severity and duration, for example, short-term, long-term, major, minor, etc. So many terms cause confusion and interfere with scientific exactitude. The time has come for greater precision.

For the purpose of statistics, we cannot include all departures from health, such as were discussed in Chapter 1. Some more clearly defined boundary has to be found both for the starting-point of illness and what constitutes it; as well as for the many variations on the theme of illness, which we need in order to measure it, such as 'new illness', 'recurrence', and 'relapse', and for the qualifying terms, such as duration and frequency, which help to define it. What the boundary line should be has not yet been internationally agreed. But national committees in Canada, Denmark, France, Norway, and the U.K. and the U.S.A. early submitted reports and recommendations.[81] For the present, the following definitions may provide a working basis:[64]

Illness. A condition included in codes (001–795) of the International Statistical Classification of Disease Injuries and Causes of Death, 1948 (latest revision) and which caused some disability during the period of time to which the statistics relate. By disability is meant that the subject was 'suffering from' it or was aware of its existence as something disturbing his state of health during the period.

New Illness. An illness which 'began' in the sense defined above at some time during the period, and which was not a recurrence as defined below.

Recurrence of Illness. An attack of illness similar to one experienced previously, any such previous attack having subsided at least one week before the present one began.

Continued Illness. An illness present throughout, or terminating during, the period, which had started before the beginning of the period.

Ill-defined Illness. A symptomatic or undiagnosed complaint included in codes 773, 780–795 of the International Classification.

Minor Ailment. Illness of defined diagnosis which does not customarily or did not, in fact, produce incapacity amounting to three days duration.

Injury. A condition produced by an external cause such as violence, accident, poisoning, or misadventure in applying a diagnostic procedure, and included in codes 800–999 of the International Classification of 1948 (as subsequently revised).

Since there are many concepts of what constitutes illness, statistically speaking, there is no internationally understood starting-point. One definition put forward is that the start of the illness is the point at which either the subject began to be conscious of symptoms or some disability, or someone else decided that disease was present of a nature which could not continue to be ignored without danger to the patient. But this definition does not include residual conditions

from past disease, or congenital abnormalities, unless they prevent the patient from living a normal life, or cause symptoms which he would describe as illness; nor would it include latent or early illness unknown to the patient, for example, incubating infections or unsuspected cancer.

Two frequencies of disease can be measured, namely, *prevalence* and *incidence*. Prevalence is *'the number of instances of illness or of persons ill, or of any other event such as accidents, in a specified population, without any distinction between new and old cases'*. It may be recorded at a stated moment (*point prevalence*), or during a given period of time (*period prevalence*). Incidence is *'the number of instances of illness commencing, or of persons falling ill, during a given period in a specified population'*.[3c] The term incidence is considered by some to be too broad for use in connection with morbidity, and is often replaced by 'inception' (Biraud). (For rates see Appendix VII.)

In both incidence and prevalence, it should be clearly stated whether the data represents numbers of instances of the disease, or numbers of persons ill; in recurring diseases, such as influenza, one person may have more than one spell, just as in cancer one person may be affected in several sites simultaneously.

The following characteristics further distinguish incidence and prevalence:

1. Whereas incidence refers only to *new* cases, prevalence refers to all cases, irrespective of whether they are *new* or *old*.

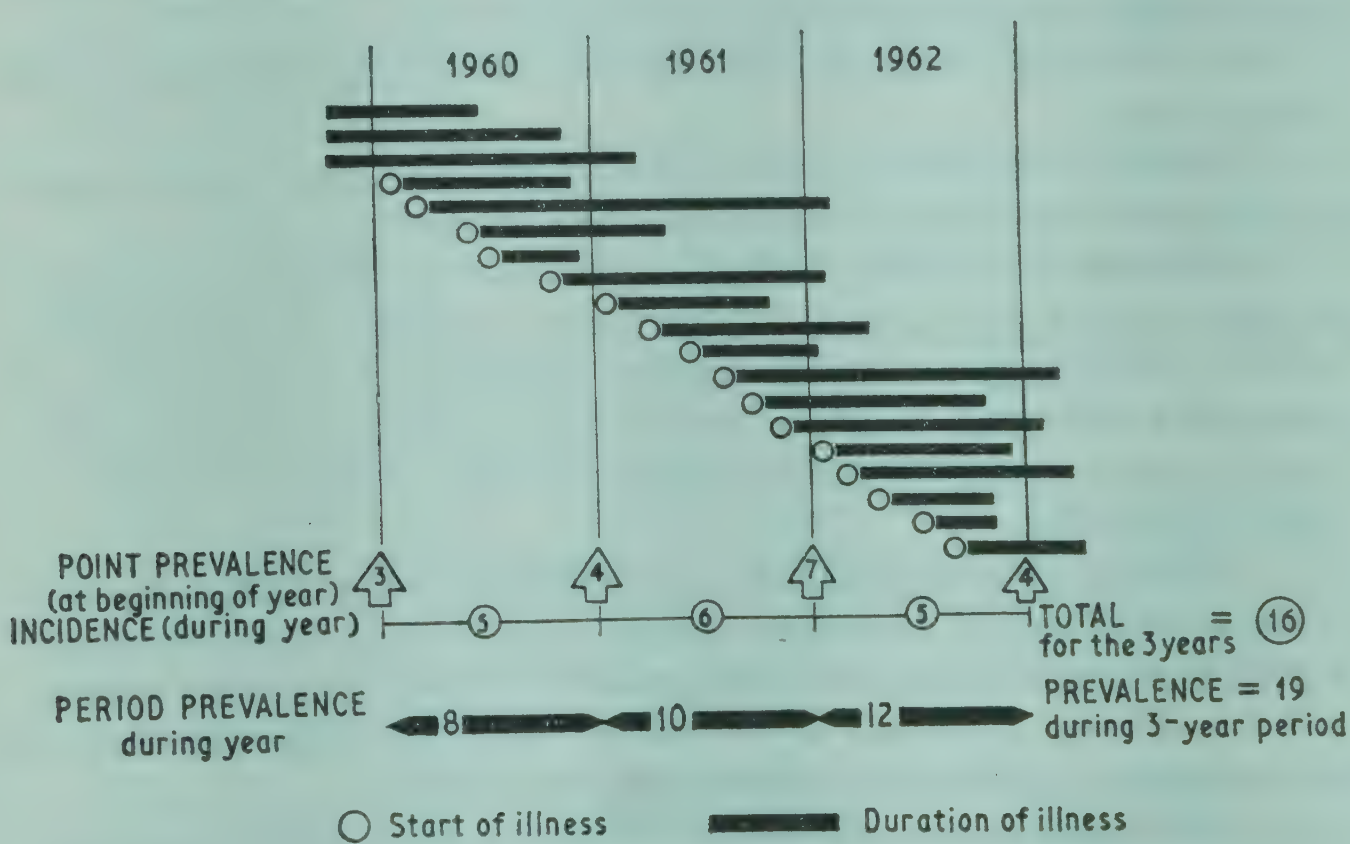
2. Whereas prevalence reflects the situation existing at a given moment (point prevalence) or provides a picture of the situation existing over a given period (period prevalence), incidence is an index of a changing situation over a stated period of time. In other words, prevalence is usually a static concept, whereas incidence is always dynamic.

3. Whereas point prevalence can be determined by a single survey, incidence and period prevalence require continuous registration over a period of time. In practice, this applies mostly to notifiable diseases and to diseases recorded in hospitals, since for other diseases no permanent or continuous registration is available.

4. While prevalence and incidence may differ widely in the case of diseases of long duration, they will differ only slightly with diseases that run a rapid course. Thus, the total number of cases of cancer, old and new, recorded in a country over a period of one year (period prevalence) will obviously be much higher than the number of *new* cases registered.

5. If the incidence fluctuates, the fluctuations may not be reflected in the period prevalence when the disease is of long duration. Thus, a sharp decline in incidence may not be paralleled by a corresponding decrease in the prevalence, because the latter may be overtaken by a fresh rise in incidence. However, if a new treatment reduces the duration of a disease, even if the incidence remains unchanged the prevalence will decrease until a new equilibrium is established. On the other hand, in chronic diseases that are incurable and ultimately fatal, a lengthening of the survival period will increase prevalence but not incidence.

An example of differences obtained through the expression of the frequency of a disease in terms of incidence and prevalence is given in the accompanying diagram. It is to be noted that, while for incidence over a long period (in this instance, three years) the total number of cases represents the sum of the number of new cases for each of the shorter periods considered (5+6+5=16), this is not true for period prevalence (prevalence for the period 1960–1962 is not 8+10+12=30; it is 8+6+5=19, since some cases stretch over two or all three of the years considered).



UNITS OF MEASUREMENT

It is possible to measure (a) the illnesses themselves; (b) the persons affected; (c) the time involved; or (d) the episodes associated with

illness. The number of illnesses can be computed in three ways as (i) those which begin during a unit of time; (ii) those which were experienced at any time during it; or (iii) those present at a given point of time.[64] The persons affected can be measured in the same three ways. The time involved can be measured in days (or other time units) of illness during a period.

Commonly it is more convenient to measure not the sickness itself, but the episodes associated with it, for example, medical care, consultation, or absence from work. When this is done, the measurements may relate, for example, to spells of *sickness absence* or *in-patient care* or to numbers who *consult their practitioners,* who *attend out-patient departments* or who are *absent sick.*

The Statistics Sub-committee of the British Registrar General's Advisory Committee, Britain's equivalent of a national committee, has suggested the following definitions for the words or terms used in these measurements (these may or may not be further amended by international deliberation):[40]

(i) The term '*case*' of sickness is intended 'to cover the whole course of one disease in one person, as far as that course is relevant to the particular inquiry concerned'.

(ii) A '*spell*' of sickness is a period during which a person is sick on one day (or shift), or on each of a consecutive series of days (or shifts).

(iii) The '*duration*' of a spell of sickness normally includes each of the consecutive days for which sickness is recorded. In measuring the duration of a spell of in-patient care, the day on which the patient is discharged should be counted as well as that on which he is admitted.

(iv) The '*number of persons exposed to risk*' at a given time should include all those who would, in the event of their becoming sick, be recorded as sick, in the context of the particular inquiry; it should exclude any others.

(v) The '*total duration of exposure to risk*' is the duration in days (or other time units) of the defined period of observation multiplied by the average number of persons exposed to risk per day (or other time unit) during that period.

Rates of morbidity can be calculated for all causes or for particular causes of sickness; they can be expressed per unit or per cent; they can be shown in terms of whole populations or in subdivisions, according to age, sex, occupation, social or economic class, place of residence, etc.

The definition of the rates applicable to the measurement of morbidity in hospital, general practice, industry, or elsewhere are given in Appendix VII. Here it is only necessary to mention that for estimating the amount of work caused by sickness in general practice the simplest account is provided by the *consultation rate,* i.e., 'the number of consultations between general practitioners and their

patients during a defined period divided by the average number of persons exposed to risk during that period'. A *consultation* can be defined as 'each occasion when a patient attends for medical treatment or advice at the general practitioner's surgery, whether by appointment, or when at the general practitioner's instigation he has treatment or advice elsewhere, other than in hospital'. Similarly, the measurement of the incidence of any particular disease in general practice is obtained by expressing the numbers who have consulted their doctor for the complaint at least once as a proportion of the patients on his list.

NOTIFICATION AS A SOURCE OF MORBIDITY STATISTICS [69a, 89]

Notification is a convenient mechanism in day-to-day public health practice, for the control of epidemic and endemic disease. This applies to countries in all stages of development, including those in which full-scale eradication programmes are being attempted. Notification is one of the main defensive weapons in keeping at bay the depredations of bacteria and parasites. But it is as valuable in peace, so to speak, as in war – in epidemiological studies in the quiet of the office, which help us to keep a running account of the geographical distribution of infectious disease. The value transcends national boundaries for which the bacterial world has no respect.

As the circumstances in which infections flourish vary so widely, so also must the need for notification. The lists of notifiable disease differ greatly in different countries. Notification can never be made uniform and precisely comparable throughout the world. The time, trouble, and cost of operating it will always be the determining factors, so that where diseases are of little significance it would be unreasonable to impose irksome regulations. The notification of abortus fever may seem valuable in Norway and not in the United Kingdom, although it is not altogether clear why not. Nevertheless there is a strong case for agreeing a basic list of notifiable diseases common to all countries; such as that devised in a South American Seminar (1953). This list, justified by the severity, risk of spread (or both), the existence of control measures capable of universal application and other technical administrative reasons, might be as follows:–

Cholera, plague, relapsing fever (louse-borne), smallpox, typhus fever (louse-borne), yellow fever, diphtheria, encephalitis (virus), gonorrhoea, influenza, malaria, meningitis (meningococcal), polio-

myelitis, rabies (human and animal), scarlet fever, syphilis, tuberculosis, typhoid and paratyphoid, typhus (murine), other venereal diseases, whooping cough.[69a] Many consider also that medical and non-medical notifications should be distinguished and recorded separately.

If absolute uniformity is impossible, nevertheless the legal sanctions in which the process of notification is invested, and its close relationship to dramatic episodes with strong emotional appeal, give it qualities of particular value in morbidity studies. Common defects, which impair the usefulness of notification, both nationally and internationally, should, as far as possible, be remedied. Among such common defects are (i) incompleteness, (ii) varying criteria for diagnosis, (iii) differing day-to-day procedures for correcting diagnoses and for avoiding duplication of notifications from more than one source, (iv) varying procedures for publishing data, as, for example, where some classify by area and others by residence, some by sex and age, and others by general total, and (v) delays in notification. A questionnaire to member states (1962) revealed that even the six 'quarantinable' diseases, with internationally agreed obligations (cholera, plague, relapsing fever (louse-borne), smallpox, typhus fever (louse-borne), yellow fever), were not universally notifiable and even when notified were generally inaccurately reported.

Lack of doctors; their indifference, forgetfulness or unwillingness; ignorance, illiteracy, superstition of the population; lack of public services; non-medical notification; absence of standard forms of briefing, of scrutiny, of correction, of fees, of laboratory facilities; suspicions about confidentiality; failure to accept death certificates – all play a part in preventing proper notification.[69a]

Some of these difficulties must be resolved locally by changes in administrative procedures, or by education of general practitioners. The fullest co-operation of the medical profession and health institutes alone can overcome incompleteness, while the development of correct procedures, which avoid duplication of notifications and which ensure that they are corrected for the final diagnosis, alone can do much to remove inaccuracies. But much can only be resolved by full international collaboration. The third report of the expert committee on health statistics (1952) recommended that the national committees of France, Italy, the Netherlands, the United Kingdom, and the U.S.A. make special studies of the problems involved.

The criterion for notification is of great importance. Here we must depart somewhat from our definition of illness as set out earlier (see

p. 2). Clearly we cannot notify persons only by reason of the fact that they consider themselves to be sick. Nor should laboratory evidence alone justify a notification, unless the notifiable disease in question is clearly defined as such, as in the case of syphilis in pregnancy. The person recorded as having a notifiable disease should be 'suffering from' it, i.e. clinically sick. Recent developments in the epidemiology of notifiable disease have only served to emphasize that any departure from this criterion is likely to lead to confusion, not only in statistics, but in administration. The finding of the causative organism in nose, throat, faeces, urine, or gastric contents does not constitute the presence of the disease; nor do thoracic shadows on a skiagram, or serum reactions to biological substances, *unless accompanied by signs or symptoms attributable to the disease.* We should resist using bacteriological, biological, and radiological tests as measures of notifiable disease without regard to what the subject is suffering from; although, of course, such special examinations may greatly help in the diagnosis of departures from normal health. The failure to make the distinction in statistical studies between the clinical presence of active disease and the detection of serological variations has led to confusion, as in statistical studies into the efficacy of BCG vaccination in preventing tuberculosis.

This narrower definition of illness for the purpose of notifiable disease does not reflect in any way upon the use of laboratory examinations in morbidity statistics in general. It is, of course, of great value to make statistical studies of serological and bacteriological reactions (Wassermann's, tuberculin reactions, and haemoglobin estimations) as determined by mass examination or otherwise. The positive tuberculin test in infants, like the positive Wassermann reaction, can help in the search for sources of infection.

Nevertheless, in view of the importance of carriers as sources of infection, there is a strong case for notification of the carrier, as such, with an internationally agreed definition to include (1) the presence of a specific micro-organism, (2) absence of recognizable symptoms or signs of disease, (3) shedding of micro-organisms in discharges or excretions, (4) liability as a source of infection, (5) restriction to named diseases, and (6) restriction to specific occupations.

Sub-clinical attacks of diseases, such as poliomyelitis, present exceptional difficulty, but the rules for their inclusion must be governed by the usual definition of notifiable disease. In each case an individual decision will have to be reached as to the presence of symptoms or signs which permit the diagnosis of a mild case of the

disease. It may be necessary to record the incident as 'ill-defined illness'.

Notifications of non-infectious disease, such as cancer, congenital malformation, mental illness, often referred to as *registration* (see p. 271) play an important rôle in the establishment of permanent registers, giving information on prevalence and providing the basis of services for care.

The calculation of rates may help both in examining the distribution of notifiable disease and in indicating preventive measures. The notification rate, an inception rate (see Appendix VII), is

> the number of notifications during a defined period divided by the average number of persons exposed to risk during that period.

It may be applied to an *ad hoc* system of notification in a special survey, as well as to the statutory system. For the calculation of rates, notification must be known to be practically complete, or, if not, allowance must be made for varying completeness in different groups of the population. Nevertheless, incomplete statistics for a local area may be useful for comparisons over a period of years, provided the factors causing incompleteness are understood and remain unchanged.

The fatality rate may be sufficiently accurate to indicate substantial changes in severity or in efficacy of treatment, for a particular disease. But this rate will tend to be overstated, since the notification of cases must always be less complete than the certification of deaths.

RECORDS OF GENERAL PRACTICE [17, 18, 36a, 69a, 83]

The study of general practitioners' records can yield rich sources of information which will help in three particular ways:

(i) to examine the detailed working of general practice;
(ii) to measure the amount of work which different diseases cause in general practice; and
(iii) to estimate an incidence for many causes of sickness.

In this latter capacity they are likely to be among the most useful sources of information, but they cannot by themselves indicate the full incidence of sickness. Minor ailments for which people do not always consult their doctor will be under-stated; diseases usually treated in hospital will not be recorded after the initial consultation and reference to hospital. The household sickness survey (see p. 289) and studies of hospital records (see p. 265) will provide some part at least of what is missing. Period prevalence rates will be subject to

the idiosyncrasies of medical terminology in use by individual general practitioners and will generally suffer somewhat from being based upon small populations. For the calculation of rates (see p. 257) the population at risk must be known. This will be known in the United Kingdom, where there is a complete list of patients under the National Health Service Act who would normally attend each practice. Elsewhere the work of defining the population at risk in an individual practice, or small group of practices, may present considerable difficulty.

Experience in morbidity studies using general practitioners' records is still limited. Logan's studies 1951/2 and 53/4[17 18] covered (i) consultations and (ii) patient consulting rates per 1,000 population in terms of 200 different diseases and conditions together with a number of other calculations designed to show the details of work undertaken, such as how often patients consulted their doctors, the rates of admission to hospital, and analyses of sickness certificates given to insured patients. A larger inquiry covering half a million patients examined 280,000 clinical records[36a] in more than 100 practices (May 1955 – April 1956).

RECORDS OF HOSPITAL

The use of hospital records for vital and health statistics has long been neglected – sadly so if we consider the immense significance of hospitals and the vast amount of valuable information which they must have had so easily to hand during the long period of their history. What records of past epidemics, what understanding of prevailing conditions in past times might now be our common knowledge, if hospitals had been accustomed to keep even relatively simple accounts of the patients who passed through their wards. What makes this defect even more difficult to bear is the fact that great minds in past times had recognized their importance and urged their close scrutiny. Florence Nightingale, in particular, understood their value; for, as previously mentioned, she submitted a reasoned statement on the subject of hospital statistics to the 4th International Statistical Congress held in London in 1870. The words which she then wrote could have been used verbatim almost a century later as a White Paper to Parliament following the National Health Service Act. 'Up to the present time', she said, 'the statistics of hospitals have been kept in no uniform plan.' She continued: –

'Every hospital has followed its own nomenclature and classification of diseases, and there has been no reduction on any uniform model of the vast amount of observations which have been made in these establishments. So

far as relates either to medical or sanitary science, these observations in their present state bear exactly the same relation as an indefinite number of astronomical observations made without concert, and reduced to no common standard, would bear to the progress of astronomy. The material exists, but it is inaccessible.

With the view of rendering the present stores of observation useful, and of collecting all future observations on one uniform plan, tables have been prepared for recording, on one common form, all the facts of hospital experience.

The forms will be submitted to the Congress. They have been already tried in several hospitals, and the results have been sufficient to show how large a field for statistical analysis and inquiry would be opened by their general adoption.

They would enable us to ascertain the relative mortality in different hospitals, as well as of different diseases and injuries at the same and at different ages, the relative frequency of different diseases and injuries among the classes which enter hospitals in different countries, and in different districts of the same country. They would enable us to ascertain how much of each year of life is wasted by illness – what diseases and ages press most heavily on the resources of particular hospitals. For example, it was found that a very large proportion of the limited finances of one hospital was swallowed up by one preventable disease – rheumatism – to the exclusion of many important cases or other diseases from the benefits of hospital treatment.

It has been shown that most of the cases admitted to the hospitals, where the forms have been tried, belong to the productive ages of life, and not to the ages at the two extremes of existence.

The relation of the duration of cases to the general utility of a hospital has never yet been shown, although it must be obvious that if, by any sanitary means or improved treatment, the duration of cases could be reduced to one-half, the utility of the hospital would be doubled, so far as its funds are concerned.

The proposed forms would enable the mortality in hospitals, and also the mortality from particular diseases, injuries, and operations, to be ascertained with accuracy; and these facts, together with the duration of cases, would enable the value of particular methods of treatment and of special operations to be brought to statistical proof. The sanitary state of the hospital itself could likewise be ascertained. The statistics of rare diseases and operations are still very imperfect; but by abstracting the results of such diseases and operations from the tables after a long term of years, trustworthy data could be obtained to guide future experience.'[48]

Spent time has gone as irrevocably as spilt milk. These long neglected threads are now being gathered together to weave the fabric on which the story of man's suffering is indelibly printed. Hospitals everywhere can play a rôle in data collection; those in less developed countries are often the most reliable source of information on morbidity. Hospital statistics can help in three important ways: (1) in research to help not only in 'rare diseases and operations', which are as rare today as in Miss Nightingale's time, but also in our understanding of the cause of common afflictions; (2) in

morbidity studies – at least of those conditions which lead to admission to an institution; and (3) in planning hospitals, both in the matter of their domestic details and in their relation to the health service as a whole.

The diagnosis of hospital cases can be made with the greater precision which results from laboratory and autopsy aids. Every effort should be made to take advantage of this. Each case should be recorded as follows:[81]

(i) Principal disease, injury, or other condition leading to admission.
(ii) Principal complication(s): the most important first and whether present at admission.
(iii) Principal accessory acute condition: whether present at admission.
(iv) Principal accessory chronic condition.

The entry under (i) should be the underlying cause, even if the cause of admission is entered under (ii).

Identifying data to be recorded should include as a minimum: name, type, and location of hospital; patient's name, national identity number, hospital registration number, race, sex, and date of birth; dates of admission and discharge; information about service referring patient (general practitioner, consultant, other hospital, etc.). A special section should provide for deaths, indicating whether an autopsy was performed and the cause of death as entered on the death certificate.

(i) *Statistics for Hospital Planning*

Statistics, which help us to understand the uses to which hospitals are put, are as essential as they have been neglected. The types of illness treated as out-patient and in-patient cases; the categories of persons admitted classified according to sex, age, civil state, occupation, duration of disorder; the period between the onset of illness and admission; the degree of conformity in diagnosis; the association between different diseases, can help to guide our plans for hospital construction. So also can the study of the hospital population help us to see hospitals in balance with other services. The information gained from the 1951 census in England and Wales may be cited as an example.[71] The 1951 census showed a preponderance in all hospitals of single, widowed, and divorced people over married – and particularly in mental hospitals and those for the chronic sick over 65 years of age. Such an observation must give us pause. It

raises vital issues, for example, the relationship of hospital to home care, which must some time be faced by all national planners.

(ii) *Morbidity in Hospital Statistics*

When we use hospital patients as a source of information about sickness in the community as a whole, we need to remember that hospital statistics are highly selective. They do not permit of generalization to the population as a whole, since they are necessarily restricted to those diseases which normally require admission to hospital and to those classes of persons who, for one reason or another, use the hospital more readily. Yet the numbers of various types of illness, classified according to the International List, and arranged according to age, sex, occupation, industry, and social class, can do much, by filling out other sources of morbidity, to present a picture of the community as a whole. For this reason alone it is important that such relatively simple recording, in collaboration with the health department, should be done in all hospitals. Hospital statistics should be produced at least annually; data should be collected through individual statistical reports completed on discharge of the patient; in long stay establishments the total of admissions and patients should be recorded on one fixed day in the year.[87]

When, however, we seek to calculate rates, using the hospital clientèle as a means to determine incidence, and prevalence, the proportions of sick from different causes, and other more difficult facts about community sickness, we encounter difficulties because of our inability to determine – except in unusually self-contained areas – the *population at risk*. For this and other reasons, the determination of incidence, and other more elaborate uses of hospital statistics in morbidity studies, must be undertaken with great care, even in countries with good statistical systems. Some hospitals, however, are in a better position than others to undertake the work. This is particularly true of reasonably self-contained areas where the whole population can be taken as the population at risk. In such cases rates of hospital morbidity can be calculated; a type of study which is much needed, both for local needs and as a general guide.

National Committees have been asked to aid the development of hospital studies in their areas, wherever there are hospitals with a defined population, and where the statistical machinery is available. The rates to be calculated are attendance rates for out-patients, and admission or discharge rates for in-patients. The out-patient attendance rate is '*the number of out-patient attendances during a defined*

period divided by the average number of persons exposed to risk during the period.' An out-patient prevalence rate (4 (a) in Appendix VII) may also be useful. The admission or discharge rate should be calculated on first admissions where more than one spell of in-patient care is normal. Most of the rates given in Appendix VI help to build a picture of the hospital in relation to all diseases and total populations at risk in different sections. Thus the study by Avery Jones[33] of peptic ulcer in hospital showed, among much else, how duodenal ulceration is advancing as a hospital episode while gastric ulceration remains stationary. Again, in a study of mothers having babies in hospitals and nursing homes, Heady and Morris[26] showed that the over forties who had lost a previous child in labour and who had a higher peri-natal mortality rate were, contrary to expectation or wise practice, less often admitted to hospital. A comparable study by Baird[3] in nursing homes and hospitals showed that, in Aberdeen at least, the hospital was safer than the mother's own home and that the unknown causes of stillbirths and neonatal deaths were an important factor in the increased rates amongst the lower social classes. It is to such further studies that we may look for a better understanding of the part played by hospitals in the health sources of a country.

For further details the reader should refer to the 8th Report of the Expert Committee on Health Statistics (1963).[87]

RECORDS OF SICKNESS ABSENCE

(i) *General Considerations*

Records of sickness absence, particularly in services affecting large groups of the population, as in schools, industry, and insurance, provide a ready-made source of morbidity data which must command increasing attention. The relationship with work or with school has its own particular value in providing information of a type which general morbidity surveys can never satisfy; it is unique in the investigation of *wastage* through sickness. For many diseases, such as bronchitis and rheumatism, which rank high in the causes of incapacity, but which rarely lead to hospital care, except in terminal states, absence from work is one of the most valuable records.

As with other sources of morbidity data, records of sickness absence have their own peculiar limitations. They cannot give a measure of morbidity of the whole population, since by their nature they relate to a part only; nor of all sickness, even medically-attended

sickness, since they do not normally cover absences of short duration. The certificates are usually for the use of lay people, so that they are subject to the unreliability of statements of diagnosis, as well as to the various factors which influence attendance. But checks can be made on the accuracy of diagnosis, for some of the more serious diseases at least, by examining employees on return to work. In London Transport in one such episode 75 per cent of the diagnoses agreed with that of the general practitioner.[54]

The units of measurement are those mentioned earlier and in Appendix VII. Particular advantages are likely to be gained by presenting the results in terms of age, sex, civil state, and various occupations within industry. The total spells of sickness absence beginning during the year and the total of numbers of days of sickness absence in any year can be presented for men, unmarried and married women in terms of age groups. Of particular value, where the numbers are large enough, are the annual inception rate in spells and the average annual duration per person, and from these the average length of spell.[62] These rates should be calculated in the same classes and groups. The sickness can also be classified according to diagnosis, using a simple grouping, based upon the international classification. In the analysis of sickness in London Transport a system of grouping into twenty broad diagnostic groups was used; a distinction was also made between absences of less than four days – for which lay certificates were often accepted – and those of four days or more for which a medical certificate was compulsory.

(ii) *Records of Sickness Absence in Individual Industries*

Sickness absence can be examined within individual industries where the rates of sickness can help in the management of the industry itself, (i) in establishing standards for applicants in different types of employment, (ii) in determining the allowance to be made for sickness, or (iii) in seeking out causes of sickness and of absence and examining the effects of preventive measures. Such studies are of equal, if not greater, interest to medicine in general, and to the epidemiologist in particular, by (iv) establishing the relationship between occupation and disease.

The amount of sickness and absence varies substantially from one employment to another. It is of value to make comparisons between different industries, between different occupations in the same industry, between the same occupation in different industries, following the records from year to year. For this 'standards of sickness absence' are needed, which can be produced only by

extensive statistical computations. *Health in Industry,* published by the London Transport Executive, was an attempt to provide such a standard.[25]

Among the clerical and technical staff in London Transport, 1950–2, sickness absence varied for different ages and according to sex and marital status. The average annual duration of sickness per person was 12·7 per annum in men aged 55–59, as compared with 5·3 at age 30–34; 16·4 per annum for unmarried women aged 55–59, as compared with 7·8 at age 30–34; and 14·8 for married women aged 55–59, as compared with 13·4 at age 30–34.[62] 'Women usually experience more sickness absence than men, age for age and job for job, and married women . . . more than single.' The same might well be true for men and would justify the time and trouble needed to discover the marital status of male employees.

Every occupational group of men or women must be, to some extent, selected. Thus, rates in industry apply to a survivor population. 'The men who continue to work at the pit face (in a coal mine) are those who have survived the physical rigours of the task.'[54] They are to this extent selected even further than the initial self and employer selection. In order to understand this process, we must supplement information of sickness absence by other calculations, which measure wastage, i.e., rates for (i) enforced premature retirement, (ii) job changing, or (iii) death in harness in different occupations. Thus, a study in the General Post Office showed that the wastage from premature retirement and death among outdoor workers results mainly from cardio-respiratory disease, which is 50 per cent higher than in sedentary workers.

The use of this new tool for establishing relationships between occupation and disease is in its infancy. Yet individual studies using occupational differences in sickness within industries have already helped to throw further light on the little understood epidemiology of degenerative disease. Thus coronary thrombosis, already shown by social class studies to follow a downward grade from the professional classes to the semi-skilled and unskilled workers, is now seen to pick out certain occupations for its most vicious attacks. Doctors, particularly general practitioners, have a greater liability. The sedentary worker in any industry is often more affected than his active counterpart; thus the post office clerk is more liable than the postman and the bus-driver than his conductor.[45] These studies, pursued in collaboration with pathologists, lead us, if they did no more, to a better understanding of the manner in which the heart muscle can be protected from arteriosclerotic disasters in the

coronary arteries, by the development of collateral circulation[46] – and so again to fresh fields of investigation and some new material for health education. So also with such observations as the absence of relationship between lung cancer and garage work and the geographical variations in respiratory disease.[55]

(iii) *Records of Incapacity in Social Security Systems*[42]

Statistics from this source, where they exist, are usually incomplete in coverage; only 5 countries in 1965 had systems covering the whole country and even fewer the whole working population. The largest single example of the use of records of sickness is provided by the 'Incapacity Statistics' of the British Ministry of Pensions and National Insurance which date from 1951 – these are themselves in a formative stage.

Incapacity returns suffer from several disadvantages as a source of statistics. Sickness benefit in the British scheme of social security is not usually paid for spells of incapacity of less than four days' duration. The diagnosis of the general practitioner in support of the certificate of incapacity for work is intended for the Ministry's lay officers; it is handed to the patient and may be available to the employer. Inevitably doctors may not always 'have recorded their diagnosis as precisely as possible'; sometimes they withhold the names of frightening or less creditable diseases. Occupation has not been generally recorded. But the gigantic task of examining the sickness records of 15,080,000 men and 4,947,000 women (1960/61) has not been undertaken without public support. The Trades Unions have, for example, pressed for the inclusion of occupation by the worker himself in making his claim; and doctors are responding favourably to the claims of this new venture in acquiring morbidity data, essential both to the development of social services and to an understanding of the work of the medical profession itself.

The analysis[42a] is done by means of a sample made up of a random selection of cases derived from each local office of the Ministry, the selection depending upon the final digit of the National Insurance number of the claimant. The statistics are presented in terms of the special list of fifty causes for tabulation of morbidity for social security purposes with extensions.

The breakdown into occupation cannot yet be done satisfactorily, even for men, because of the inadequacy of the returns; and not at all for women, of whom large numbers are uninsured; and for those that are insured the population at risk cannot be calculated. Never-

theless such relatively simple compilations are of immense value in helping us to understand the relative frequency of illness as a cause of incapacity.

In 1962 there were in Great Britain 9,002,200 new claims to sickness benefit. The number incapacitated (on the third Tuesday of each month) varied between a maximum of 1,352,400 in January to a minimum of 801,800 in August. The proportion of sickness in each age group was closely related to the size of the group; thus the 15–19 group had 18·3 per cent of the total sickness and 18·5 per cent of the population at risk; the 60 and over group had 1·3 per cent of the total sickness and 1·7 per cent of the population.[42]

The spells of certified incapacity due to sickness (8,302,020 terminating in 1960/61) comprised in all 278·94 million days (199·88 million males, 79·06 million females). Of these some of the main causes were as follows:

(1) Influenza, bronchitis, pneumonia, acute pharyngitis and tonsillitis, hypertrophy of tonsils and adenoids, quinsy, chronic sinusitis and the common cold together caused 3,447,920 spells totalling 62·18 million days.
(2) Psychoneuroses and psychoses caused 221,180 spells totalling 26·25 million days.
(3) Tuberculosis of the respiratory system caused 23,320 spells totalling 8·07 million days.
(4) Accidents, poisoning and violence caused 671,020 spells totalling 19·04 million days.
(5) Diseases of the stomach and duodenum (excluding cancer) caused 465,900 spells totalling 11·76 million days.
(6) Boil, abscess, cellulitis, and other skin infections caused 221,860 spells totalling 2·76 million days.

The relationship of each disease, or group of diseases, or a cause of sickness absence, can be further studied by age and sex. Thus tuberculosis, on 5 June 1953, was the cause of illness for 45,200 male claimants, out of a total of over half a million (540,200). The number of men claiming was at its highest within the age span 25–60 years. In the seven five-year age periods of this span there appeared to be little variation in numbers claiming, i.e. from 4,600 to 5,700. The numbers of women claiming, on the other hand, was at a much lower level (27,100), and it was highest in the earlier age span up to 35 years; the highest number of women claimants, 6,700, occurred in the age group 20–24. After 35 years, the number of women claimants fell to levels of 800–1,800, very much below that for men. Well over half the men (28,500) and nearly four-fifths of the women (20,100) had been claiming continuously for more than a year. With such additional details as these, the impact of tuberculosis upon an industrial society can be seen more clearly than is possible with figures of notification or morbidity alone.[42]

CANCER REGISTRATION[4 7 27 32a 53 65 85]

Cancer is one of a group of diseases (with tuberculosis, mental illness, congenital malformations) for which notification needs to be supplemented by continuous supervision. For this process, which requires sophisticated medical and social services, *registration* is a more accurate description, if only because one of the aims is to build up complete registers.

Morbidity from cancer has been studied only in recent years – mainly because of the exceptional difficulties which it presents. Tumour registration began in individual hospitals in the nineteenth century; but comprehensive cancer registration only recently. It began in Massachusetts (U.S.A.) in 1927 followed by New York State in 1940. After this it spread steadily–Denmark (1942), France (1943), England and Wales (1944), California (1947), Pennsylvania, New Zealand (1948), Norway (1952), Finland, Belgium (1953), Iceland, Israel, Netherlands (1954). The disease does not lend itself to traditional notification – i.e. reporting by law – if only because the great detail required, and the long process of follow-up, must be conducted through special centres.

In England and Wales the first steps in the introduction of a scheme for recording cases of cancer on a national scale were taken by the Radium Commission (1930–48), which controlled the supply of radium to radiotherapy centres. National registration proper began at the end of 1944, when the Ministry prescribed registration and case-abstract cards for approved local authority schemes (Cancer Act 1939). A conference, held in Copenhagen in September 1946, arranged by the Danish Cancer Registry, suggested that: (1) great benefit would result from the collection of data about cancer patients from as many different countries as possible; (2) that data should be recorded on an agreed plan so as to be comparable; (3) that each nation should have a central registry to arrange for the recording and collection of data; (4) that there should be an international body with the duty to correlate the data and statistics obtained in each country and to devise a terminology and methods of classification and tabulation to be used by all co-operating countries.

In 1950, the World Health Organization appointed a committee to consider the registration of cases of cancer – a sub-committee of its Expert Committee on Health Statistics.[80] The Committee recommended that (1) efforts should be made to determine the total incidence of cancer in populations of sample areas within several

countries during the year or period of years, using all available sources of information (for example, doctors, pathologists, hospitals, death certificates); and (2) that cancer registration projects aiming at ascertainment of follow-up histories of patients be encouraged with a view to eventual inclusion in such registration systems of all persons affected by cancer – thus eliminating selective bias, so as to arrive at true morbidity, survival, and apparent recovery rates. It also recommended that the statistical classification of cancer should be based upon numbers 140–205 of the International Statistical Classification of diseases, injuries, and causes of death.

The object of a cancer registration scheme is to obtain information about (i) the incidence of cancer in relation to age, sex, and site; (ii) methods of treatment employed; (iii) survival in relation to the extent of disease when first diagnosed; and (iv) the interval between the earliest symptoms and the patient's coming under observation and treatment. The details of every case of suspected malignant disease must be entered on a *registration card* filled in at 'registering centres'. Centres can be either individual hospitals, or radio-therapeutic centres, acting for a group of hospitals, or area organizations responsible for all registration within their areas; they can be statutory or voluntary. Each registering centre should report to the General Register Office every new case of malignant disease encountered – by sending duplicates monthly. A registration card in duplicate should be completed for each case of cancer or suspected cancer, whatever the route by which it comes under observation, and in whatever way it is eventually handled. The card should be made out as soon as there are reasonable grounds for a provisional diagnosis of cancer. If a hitherto unsuspected cancer is discovered during treatment for some other condition, or at a post-mortem, this too must be registered. Registration in these circumstances makes it impossible, in many cases, to record a final diagnosis, but an indication of the first estimate of the situation should be entered under 'provisional diagnosis', even in indeterminate cases; for example, a doubtful lesion in the pharynx should be entered 'lesion pharynx – ? carcinoma'.

For every registration card an *abstract card* is sent later – whether the disease proved to be malignant or not, and whether or not it was treated. The abstract cards form the basis of continuous follow-up reports at intervals. They give additional information about the date and symptoms of onset, the state of the disease at registration, diagnosis, clinical findings, histology, and treatment. Every effort must be made to determine the first event, for example, cough,

swelling noted, pain, bleeding, etc. Each case is followed up by calendar years from the time of the first main treatment up to 5 and then afterwards at 7, 10, 15, and 20 years. Registered cases which the corresponding abstract cards later show to be non-malignant are excluded. By checking abstract cards, with the aid of the index, cases registered by more than one centre can be detected.

Cancer statistics are (1967) now available in 67 countries; in 53 they cover the whole country; in 50 they are based on registration. In England and Wales during the first year of registration (1945), when comparatively few 'centres' were participating,[53] the number of registrations was about 27,000; in 1948 it was 49,810, in 1953 it was 65,597. Registration in England and Wales (1967) probably amounted to nearly $\frac{3}{4}$ of the new cases occurring.

The full benefits of registration are yet to come. As they become more complete they will add increasingly to the data available for the study of regional and racial differences, which may well bring out environmental and possibly preventible factors.[85] The significant differences which occur in the incidence of cancer throughout the world have been dealt with elsewhere (see Chapter 5). But we have also to be able to examine the significant local variations which exist in individual countries. In comparing cancer death rates with standardized rates for tuberculosis in certain of the counties of England and Wales, for example, it can be argued that the effects of local conditions 'must be almost as important for the one disease as the other'.[65] The high incidence of gastric cancer in North Wales, in marked contrast with the low incidence in the East, the South, and the Midlands of England, may be due to an environmental factor, possibly a lack of fresh milk and vegetables. It may be more important to study local differences, in countries where reliable statistics exist, than to probe into the phenomenon of almost total absence of cancer of the stomach in Java, which astonishes every medical visitor to Indonesia. Clearly we must hasten on with our statistical book-keeping. So much suffering and death, so much surgery, so much time of hospitals and doctors, might be saved.

SICKNESS SURVEYS

Sickness Surveys are dealt with in Chapter 26.

CHAPTER 25

The Use of Sampling in Morbidity Surveys and Public Health Investigations[92 96]

THE examination of vital events for a whole nation is a difficult and expensive business; so also is the process of extracting vital statistics from registration data, and, as is often required, the further step of asking additional questions on health matters. The difficulty and cost may be so great, particularly in under-developed countries, that the work of obtaining vital and health statistics may well in fact not be done. Any means of reducing the difficulties and cost involved must help, not only in the countries that have no complete census, nor any general registration system, but also in the developed countries, where the volume of detailed information sought may have become burdensome. For some part of the answer to this important issue we may look to *sampling*.[49] Sampling cannot replace registration in the legal sense, since it does not register everyone, but it can act as a pilot venture upon which to build a model for full registration later. For the production of statistics it can be effective, economical, relatively speedy, and a source of data of high quality.

Since for the whole nation we are intending to substitute part, the selection of the part is all-important; everything therefore depends upon the design of the sample. For this highly technical task *'It is desirable that a highly skilled mathematical statistician versed in recent sampling developments be charged with the task of sample design, the determination of sample size and procedures, the determination of estimation procedures, and the calculation of sampling errors'*.[23] Given expert advice, however, the task is relatively simple; and after the sampling unit has been established the operation can be conducted by local staff.

The smallest parts of the material to be sampled are called *elementary units;* the units which form the basis of the sampling process are known as *sample units*. The aggregate of the sample units selected constitutes the *sample*. Various refinements of the sampling process have been devised either to help to make the sample more representative, or to arrange the work in stages or

phases. *Stratification* is the name given to the process of sampling when the elementary units are divided into groups and strata, each being sampled separately, so that a specified number of sample units is obtained from each stratum. In this manner it is possible to distribute areas in such a way that a number of different characteristics of the country – economic, ethnic, rate of growth, income levels, etc. – have a chance of fair representation. The greater the use made of information about the characteristics of the country, the better the results of the sampling method. In *multiple stratification* the elementary units are divided simultaneously according to two or more classifications – geographical, quantitative, and qualitative.

In *multi-stage sampling* the elementary units are regarded as made up of a number of first-stage units each of which is made up of second-stage units, and so on. Thus each country may be divided into districts; each district into villages; and each village into farms. A number of districts is selected in the first stage, within each a number of villages in the second stage, and from each selected village a number of farms is selected at the third stage. *Multi-phase sampling* is used when it is convenient and economical to collect certain items of information on the whole of the units of the sample, and other items on some of these units – drawn as a sub-sample of the original sample. *Interpenetrating networks of samples* collect the information from the same domain of study in an independent manner – so that each sample would supply an independent estimate of the varieties under study. This provides a means of appraising the quality of the information. *Composite sampling* is the term given to the process which uses different methods of sampling for different parts of the material, for example, sampling human population in the rural parts of the country and households in the towns. For further details see *The Preparation of Sampling Survey Reports* (1950),[49] and *Sampling Methods in Morbidity Surveys and Public Health Investigations* (1966) WHO Tech. Ref. Ser. No. 336.

In under-developed countries the fundamental design for sampling is a list of areas in substitution for the list of households or persons usually used, so that it is possible to select areas, which together are a miniature in every respect of the complete country. Each of these selected areas must be staffed for the purposes of registration, exactly as they would need to be in a complete registration system; there can be no saving in this. At the outset, birth and death data, the first priority, alone should be compiled. If censuses have been taken, the same registration areas can be used to obtain current

figures, each year, by adjusting for births, deaths, immigration, and emigration. For the calculation of rates, estimates of population must also be provided. If these are not available from a relatively recent census, the sample registration areas can be adapted for census taking by the simple expedient of taking a sample survey within them. In making a sample registration scheme, to avoid bias, it is usual to exclude model public health areas, or to deal with them as a separate entity.

In countries with full registration, sampling by areas can be used to detect weaknesses, to examine procedures, to check for completeness, and to prepare for advance tabulations. Systematic sampling of the records obtained by a full registration system, or by other means, such as the census or sickness insurances, can be used to obtain information for research purposes, or to reduce to a manageable form the enormous task of examining large-scale returns. Thus the results of the examinations of sickness benefits by the British Ministry of National Insurance are presented in the form of sample analysis – an economical and effective substitute for complete analysis, or if desired as a means to obtain advance results. In the U.S.A., a 10 per cent sample of deaths, systematically selected by each State, is forwarded as an advance statement to the Federal Department, thus providing a provisional national mortality in advance of regular tabulations. In Sweden, a sample birth register has been established which includes all births occurring on the 15th day of each month; it permits complex tabulations, which would otherwise be a heavy expense. Sampling also helps to overcome the hazards of incompleteness which result from resistance by doctors to 100 per cent reporting.

Sampling in vital and health statistics has its most important application in survey work. In addition to its use in censuses, the sample survey has been applied to the measurement of many important criteria of health in the community, throughout the developed and under-developed world (see below). The method is now being widely promoted by WHO, as a means to examine vital and health statistics, and through these to improve health services.

SAMPLING IN SURVEYS

After Francis Galton had invented the coefficient of correlation – followed by his survey method in inheritance through studying twins – and Karl Pearson's tests of significance, including 'chi square', a

new mathematical outlook eventually revolutionized all survey work. In 1912, A. L. Bowley, in his study of five towns, introduced *random sampling*.[34] Up to this time, with the exception of Smith's dietary survey, all surveys had examined the whole of a group or a complete area, an enormous task, as illustrated by Booth's work in London, which took eighteen years and involved the labour of many persons.

Bowley's study in Reading was based upon a sample of 1,840 households – i.e., 1 in 10 of 18,000 households on the rating list. Bowley also recalculated Rowntree's results in York to show that they could have been produced by a 1 in 10, or even a 1 in 50, sample at a great saving of expense, time, and effort. After World War II, and the United Nations Statistical Commission, Yates wrote his classic work *Sampling Methods*;[96] a sub-commission of statistical sampling drew up a guide to investigators, with a recommended terminology (1952).[49]

Sampling extended the use of surveys by area probability sampling. This provides an attractive alternative to the full census, in sub-continents like India, where complete enumeration is cumbersome and the ensuring of accuracy is a gigantic operation (Bhore)[32] – a country where vital rates on population growth, marriage, fertility, infant and general mortality are not yet accurately known, since marriages are mostly religious and are not registered, and birth and death registration is defective. In the immediate future, sample surveys appear to be the only practical approach in many countries to the ascertainment of basic vital rates.[37] The National Sample Survey of India, begun in 1950–1, employs a staff of 600; it operates in the form of two or more 'rounds' of surveys on a country-wide basis every year, covering both rural and urban areas. From the second to the sixth 'round', information was collected on age at marriage, interval between successive births, sex, and age of children born, and detailed economic and social data. The household, as the sample unit, is defined, on the lines of the Indian census, as a common messing unit of persons, who have lived together, and taken food from the same kitchen, during a period of sixteen days or more out of thirty days preceding the date of investigation. Sample surveys have also been made in Africa.[59]

Many other measurements of health in the community – social, socio-medical, and medical – have been made in recent years by means of the Sample Survey,[58] for example, nutrition studies (Japan and the United Kingdom), heights and weights of children (France), the use and misuse of alcoholic liquors (Sweden), family budgeting

inquiries (Sweden, U.S.A., U.K.), the effect of the home on education (U.K.), etc.

In 1940 the National Food Survey Committee in the United Kingdom began surveying by the sampling method.[67] In 1950, in 4,723 households (3,837 urban and 886 rural), housewives were asked to keep a record for one week of all food purchased for the family, and of all food from garden and allotments and otherwise obtained without actual cash payment. Visits of investigators were preceded by introductory letters to explain the use of the log book for recording weight and cost of food. During the week of the survey two visits were made; food stocks were weighed immediately before and after the survey. The results compared the diet in different economic and social levels in relation to family size, etc. as illustrated below:

Nutrients	*Childless households*	*Families with more than three children*
Energy value (calories)	2,804	2,168
Protein (grammes)	91	65
Animal protein (grammes)	47	30
Fat (grammes)	118	86
Calcium (milligrammes)	1,212	959
Iron (milligrammes)	15·9	11·3
Vitamin A (international units)	3,949	3,201
Vitamin B (milligrammes)	1·17	1·33
Riboflavin (milligrammes)	2·17	1.43
Nicotinic (milligrammes)	15·4	10·4
Vitamin C (milligrammes)	102	61
Vitamin D (international units)	167	201

This shows a decline in diet with size of family.

Children in one-tenth of the secondary schools of England and Wales – a stratified sample – were studied for the relationship of home and school. A questionnaire asked for details of progress from entry in 1946 to leaving in 1953 or earlier. Scholastic attainment, related to father's occupation, was shown to vary greatly with the home; only 9·2 per cent of children entering school from the unskilled home sat for advanced level certificate, as compared with 48 per cent of the children of professional parents; 71 per cent of the unskilled workers' children left school without obtaining more than two passes at the ordinary level. 'The reasons for this phenomenon,' said the report, 'must be very complex and we do not claim

fully to understand them . . . it is most important that further research into the problem of the effect of the home background, particularly that of the semi-skilled and unskilled worker, upon a child's education at a grammar school should be undertaken.'[10] This subject was further studied in relation to University entrants (1963).[3a]

The Sickness survey in England and Wales (1944–52), which arose out of the wartime need to know more about general levels of sickness, 'the consequential incapacity and calls upon the services of doctors', was the work of the Social Surveys Division of the Central Office of Information, working with the Ministry of Health and the General Register Office.[53] A stratified sample of 2,910 persons over 16 years old was drawn from 11 regions, divided into rural districts and towns of four sizes. Specific towns and districts were selected; and within each a random sample was drawn – originally from Food Office records, then from National Registration records (1944), and finally from the electoral register (1951). Thus in the North-West region, containing 15·6 per cent of the total population, there were 454 interviews, of which 43 were allotted to rural districts (9·4 per cent of the population); 74 to towns of between 40,000 and 80,000 (16·5 per cent of the population), etc. When the frame for the selection of the random sample in each area was the National Register, as in Blackpool scheduled for 53 interviews, the total block of cards for the 115,000 adults (1,240 inches long) was sampled by measurement; 1 card was picked out of every 23 inches. Interviewers visited the sample of people in their own homes, inquired about illnesses and injuries during the three previous months, and recorded on a designed schedule the illnesses mentioned by the subject and not according to the interviewer's diagnosis. The results were examined, using the measurements outlined in Appendix VII, for totals of illness, days of incapacity, and consultations, together with the appropriate rates for consultation, incapacity, prevalence, etc. Sickness and incapacity also were related to occupation, income, and density of living.

CHAPTER 26

Methods of Collecting Data

DATA can be collected from a great variety of sources – existing and specially designed; and both the sources and the methods can be classified in different ways. The following classification has been adopted for convenience of systematizing; the classes are not mutually exclusive.

Data collected by experimentation
Data collected by observation
- (1) already recorded
  - (a) existing data { primary sources / secondary sources
  - (b) extracted data
- (2) specially designed records
- (3) collected in the field (surveys).

DATA COLLECTION BY EXPERIMENTATION

Experiments are planned studies designed *to provide data by measurement;* thus in medicine, preventive medicine, sociology or psychology they provide the circumstances in which the effects can be measured of subjecting the human being to differing courses of medical treatment, of social measures or of psychological devices. Experiments seek to establish relationships between varying factors by controlling all other variables. In making objective observations the greatest care has to be taken in defining the measurements themselves. Experiments are not the only means to deduce cause and effect; but they are generally speaking the most searching and the most likely to reach definite conclusions. They can be used to learn more about the nature of disease, the effects of various forms of treatment, or the success or otherwise of preventive measures; they can equally help to unravel the complexities of human behaviour and of social problems. They have a place in health education and in speeding up the rejection or acceptance of preventive measures. In disease, they can help to solve problems not only of acute and

dramatic disease but also of chronic illness, of less important maladies and of the many lesser misfortunes of mankind. The chief distinguishing characteristic of an experiment is that it takes place *in controlled circumstances*. Thus the basic requirement of most experiments, including clinical trials in medicine, is that they should have *concurrent controls*, i.e. a group acting as controls at the same time as the experiment. Experiments seek information about groups with similar characteristics differing only in a particular treatment given, i.e. the preventive, sociological or psychological measure which is imposed. Success lies very largely in *the integrity of the control sample* and in *the elimination of conflicting* variables. These two requirements for success are difficult to achieve; so that inadequate controls constitute an all too common cause of failure in experimentation. Volunteer groups (acting as controls) by their very nature of coming forward to volunteer differ from the experimental group. Thus the control group may differ not only in the treatment given but also in a number of other characteristics, e.g. the co-operation of parents, the attendances at clinics or the high proportion of only children. Those conducting experiments need highly technical skills in some particular branch of experimental sciences.

DATA COLLECTED BY OBSERVATION

(1) Data already recorded.

Data exists in a wide range of records from newspapers, magazines, almanacks, writings, films, legends or personal documents on the one hand to a variety of official compilations on the other hand. Official compilations exist as part of a registration process, in insurance data and in a multiplicity of parts of the health service – in records of general practice, of hospitals, clinics, industrial health, maternity and child welfare, school health and various aspects of public health (see Chapter 21). They form part of services which exist for other reasons than research – although research itself may be designed to learn more about them.

Recorded data may be in the form originally collected, e.g., in the census, when it is *primary*; or it may already have been compiled into *secondary* records, e.g., data in publications by the Registrar General. In both instances it exists in a form which allows immediate study; in contrast data in writings and films needs to be extracted before it can be used. Such *extracted* data can be useful in studies of behaviour. Recorded data has the disadvantage that it permits of retrospective examination only and has therefore to contend often with lack of relevant facts.

DATA FROM SPECIALLY DESIGNED RECORDS

Designed records are maintained in such a way as to further the collection of relevant data for research purposes. Such records perform a double purpose; they provide the usual official record of a service, data for administration as well as clinical activities, and they record other data for research on a prearranged plan. The dual function is compatible with, and often beneficial to, efficiency in the operation of the service. Thus in the National Health Service in Britain, hospital records have been redesigned to provide data for research; records of the Mental Health Service in Salford have been redesigned to enable an epidemiological study of the Mental Health of the whole community to be carried out. The designed record is valuable for operational studies of services. Since it starts with the designing of new records rather than the use of old ones it can be *prospective* in character.

DATA COLLECTED IN THE FIELD (SURVEYS)

Data can be collected in the field by asking questions or doing tests, the results of which are recorded in pre-established categories. The questions are formed in such a way as to bring out certain kinds of answer. This form of data collection is known as a survey, i.e., *an individual inquiry the results of which can be statistically analysed*. The object of a survey is to obtain data with which to make comparisons between groups or within the same group at different times. It can gather *facts* or *opinions*. It must be objective and, even when dealing with opinions, feelings or reasons, it has to quantify, since ultimately it deals in numbers, adding up units to make totals and calculating percentages and rates. The data may be the result of observations, measurements or questions; or a mixture of all three. Measurements are most exact. Observations and measurements, where appropriate, are generally preferable to questions (just as facts are preferable to opinions and questions on facts preferable to those on opinions). Nevertheless, observations and questions can be standardized by grading qualitatively – e.g. the state of damp in the walls of a house can be graded as much damp, damp, little damp, no damp – and grading by this means can become for the purposes of the survey an excellent effective substitute for measurement.

Surveys are subject to inconsistencies arising from human errors in observation when one observer records a different state altogether from that considered to be correct and which has been made by

other observers. *Observer errors* should be distinguished from *observer variations,* which occur when a condition is being classified into one of a number of variables on a continuum – as e.g. much damp, little damp, no damp as applied to the walls of a house. There will be observer variations in degrees of dampness bordering on the lines of demarcation between damp, much damp and little damp.

The inquiry may be addressed to all members of a group or to a sample – the latter being more usual in view of the difficulties of obtaining the whole of a group, which may be too large or too inaccessible. The subject of study, or units, whether the whole of a group or a sample, must be taken, where possible, from an existing document or record which is known as *the frame.* Thus the frame provides the subject matter of the survey – the list of units to be studied. It may be found in a great variety of documents dependant upon the subject – lists of patients in a hospital ward, an electoral roll, areas on a map, food rationing files, a census or registration list, etc., etc.

Various categories of surveys can be distinguished. In our context, they may be *social, socio-medical,* or *medical.* Social surveys analyse the circumstances in which people live; socio-medical surveys relate findings to medical phenomena (biological, physiological, pathological or clinical data), e.g., sickness can be related to the facts of industrial life, syphilis to prostitution, tuberculosis to density of living; medical surveys deal with disease as a group phenomena – its distribution in time and space, sickness in general or tuberculosis in particular – without attempting to relate the findings to social factors. They may be *multipurpose,* when a wide range of factors is examined, or *special purpose* when a single set of complex factors is under review.[91] They may constitute a *single phase* operation, when the group is examined first and last in one step; or *multiphase,* when a second or third more intense examination is made of smaller fractions of the group.

Surveys can be *national,* where the population to be studied covers the whole country, either absolutely or by means of sampling; or *local,* where the population is confined to one area, as in the case of a town studied for the extent of poverty. They can also relate to a group with a particular characteristic, as, for example, expectant mothers booking for hospital delivery, or perhaps the hospital itself.

Surveys can be distingushed as either *diagnostic or descriptive.* Diagnostic surveys seek to prove a relationship between two or more factors, when they are either analytic in the sense of being *retro-*

spective, or as longitudinal follow-up studies, *prospective*. When we look forward we may follow established cases in an attempt to learn their life history, or we may take a group of persons and follow them over a spell of time to determine the numbers who develop a particular condition, or the circumstances which surround its development. Prospective studies can be made satisfactorily only in groups of sufficient size to produce enough cases, which involves planning and sampling to the correct size; they have been performed in diagnostic surveys to determine the relationship of cancer of the lung to smoking,* which involved a questionnaire returned by approximately 39,000 doctors.

They are of value for conditions which are relatively frequent, for example the common cold, bronchitis, or coronory thrombosis, but are not easily adapted to rarer diseases, such as von Willebrand's disease or even disseminated sclerosis. Some do not regard the follow-up of established cases as a truly prospective survey, since one is looking back as well as forward. Truly prospective studies can provide stronger evidence of causal relationship than can the retrospective inquiries, often prejudiced by failing memory or lack of relevant data.

Most of the surveys with which we are concerned in vital and health statistics, however, are *descriptive*, seeking to paint a picture of a number of different characteristics, which significantly distinguish the group. In a survey of sickness the incidence and prevalence of a variety of different diseases is measured – or, in a study of old age, the social background. Thus they describe an existing situation. Descriptive surveys are sometimes, but not always, *exploratory* in the sense that they make a preliminary estimate of important findings, some or all of which need to be studied more intensely by diagnostic surveys.

Surveys are not new, except in their increasingly scientific management. They have been made in some form in every civilization. In Europe, one of the earliest was that of the Domesday, an inventory of land, people and goods in Britain (1088), obtained by questioning by a panel of twelve jurors on oath in public court in every township and manor. Surveys developed widely in the 18th century, when censuses began. John Howard, Sheriff of Bedfordshire, wrote *A Winter's Journey* in 1777, the result of a pilgrimage

* Reports were published by R. Doll and A. Bradford Hill in the *British Medical Journal*, 1952, ii, 1271, and 1956, ii, 1071. See also P. Stocks and J. M. Campbell, *Brit. Med. J.*, 1955, ii, 923; *Smoking and Health*, 1964, U.S. Public Health Service No. 1103.

through the prisons of Britain and the Continent.[28] This survey was undertaken in the conviction, which came to Howard as he sat on the Bench, that prison conditions were bad for health and harmful to society. His observations, which covered the health of the prisoners, their food, living conditions, and sanitation, were embodied in a *critical analysis*, a work of imagination and scholarship, a model for all surveyors, despite his modest disclaimer that 'a person of more ability, with my knowledge of the facts, would have written better'.

> Certain it is that many of those who survive long confinement are by it rendered incapable of working. Some of them by scorbutic distempers; others by their toes mortified, or quite rotted from their feet, many instances of which I have seen. . . . In order to redress these various evils, the first consideration is the prison itself. Many county gaols, and other prisons, are so decayed or ruinous, or, for other reasons, so totally unfit for the purpose, that new ones must be built in their stead.[28]

Howard may well have been the first to introduce the *critical appraisal* – 'as the means of exciting the attention of my countrymen to this important national concern'.

The nineteenth century witnessed a continued growth of surveys. *The Sanitary Condition of the Labouring Population of Britain* by Edwin Chadwick was published in 1842, and was followed almost immediately by Shattuck's survey in Massachusetts (1850). Edwin Chadwick, Secretary to the Poor Law Commission in London, believed that pauperism was caused by preventible illness and that money spent on public health would save that spent on paupers (see Chapter 14). He circularised the parish doctors in every 'union' or group of parishes appointed to give free medical care to paupers, with a questionnaire on 29th September 1829. Like Howard, Chadwick wrote his final report with imagination and keen critical ability.

Between 1858 and 1871, Sir John Simon, Chief Medical Officer to the Central Health Authority (the Privy Council) in London, conducted a variety of surveys of socio-medical and medical subjects.* Simon had a feeling for social problems and a flair for finding medical men whose particular experience had equipped them to make individual inquiries in a wide range of important subjects. In 1863 Edward Smith[60] did a dietary survey; in 1864 Julian Hunter[29] a housing survey; and in 1860–61 Edward Headlam Greenhow[15] surveyed sickness in industry.

* Royston Lambert gives a detailed account of this period in *Sir John Simon and English Social Administration,* 1816-1904 (1963), London, MacGibbon & Kee.

Edward Smith, in perhaps the first dietary survey ever made, studied silk weavers, throwsters, needlewomen, kid-glovers, stocking and glove weavers, shoemakers, and the agricultural labourers throughout Britain. He introduced two indispensable aids to survey work, the sample and the standard of measurement. His study was national in the sense that he covered the whole country; but, since he was unable to visit all the households whose menfolk worked in the industries mentioned, he had to select a sufficient number from each to make his results representative of the whole. Smith chose 634 households, which, he said, he took care to make 'thoroughly typical'.[60]

In order to compare the diet of individuals or groups of individuals Smith had to find standards of measurement. He first supposed that everyone of ten years and over required the same amount and quantity of food and that two children under ten years could be regarded as equal to one adult. This was rough and arbitrary, and fairly wide of the truth, but we still have no exact means of converting children and adults of various ages into a standard unit. Smith also needed a standard of diet to be regarded as a minimum for his standard unit. He therefore postulated – on the basis of his research in physiological chemistry – a standard daily diet of 28,600 grains of carbon and 1,330 grains of nitrogen. Smith visited 553 households in England and Wales, 52 in Ireland, and 29 in Scotland – a formidable undertaking. He himself interviewed the family and made a record, by inquiry of the housewife, of the amount and cost of various foods consumed. These totals he converted into his standard diet, as the following table shows:

Class	*No. of families examined*	*Average weekly supply of each adult*	
		Carbon grains	*Nitrogen grains*
Silk weavers	42	27,620	1,151
Needlewomen	31	29,900	950
Kid-glovers	10	28,623	1,213
Shoemakers	21	31,700	1,332
Stocking-weavers	21	33,537	1,316

In comparison with these low levels, the diet of the agricultural workers was better; nevertheless, 'a fifth were with less than the estimated sufficiency of carbonaceous food, more than a third were with less than the estimated sufficiency of nitrogenous food' and in three counties the average diet was deficient in nitrogen.

Smith wrote his report in exemplary fashion, setting out how he came to undertake it, how he drew his sample, the difficulties he

encountered, the methods he adopted, and his results. A summary of his findings for the indoor workers was as follows: (1) no class under inquiry exhibited a high degree of health; (2) the least healthy classes were the kid-glovers, needlewomen, and Spitalfields weavers; (3) the average quantity of food supplied was too little for health and strength; (4) the worst fed classes were the needlewomen, silk weavers, and kid-glovers; (5) as a class they did not spend their money upon food economically; (6) the instances of Macclesfield weavers and of London needlewomen show in remarkable contrast the effect of economical and wasteful expenditure of money on food. Smith's survey left little doubt that 'the degrees of scantiness of food which were to be found among the lowest fed of the examined classes' must be the cause of illness and that the associated causes of disease must be greatly strengthened by it and their hurtfulness'.[60]

During the early part of the twentieth century, the thoughts of two remarkable people – Seebohm Rowntree and Charles Booth – were centred upon poverty. Chadwick had believed, and demonstrated, that poverty could be rooted in ill-health and disease, much of it preventible. Booth and Rowntree saw poverty as part of irregularities of employment and inadequate wages, aggravated by the biological processes of family growth and old age. Booth spent seventeen years of his leisure in the East End of London to produce his *Life and Labour of the People of London*, 1883–1897. Rowntree did the same on a smaller scale for the city of York, and published his report under the title of *Poverty: A Study of Town Life in* 1901. Rowntree is remarkable for having been sufficiently single-minded and long-lived to have completed two further surveys in the same town – *Poverty and Progress* (1941), and *Poverty and the Welfare State* (1951). Neither Booth nor Rowntree made any attempt to sample. They used a team of carefully briefed investigators to visit all households. Booth in addition used the records of the visitors appointed by the London School Boards. Both Booth and Rowntree used standards for comparison. Rowntree fixed minimum standards of diet and household expenditure and arranged his households in economic groups according to the wage of the chief earner. Booth made the first attempt to standardise occupation.

In recent years surveys have been undertaken in vast numbers – so great has been the advantage of learning about what has been styled the anatomy and physiology of society. Surveys, now in a sense mass-produced, have gained much from improved methods of measuring by the use of standards, as for occupation (see

p. 244), for social class (see p. 247), for household densities, for diet and other attributes. Dietary standards have gone far beyond Edward Smith's early concept – they provide a measurement of the utmost national and international significance. From the 1930's and through the second world war, surveys by individual inquiry, some based upon sampling large populations, many through the examination of complete or nearly complete local groups or selected areas, have developed widely in many different fields of work, through the Western World and elsewhere. Opinion surveys, originally designed for market research and for political science, have been used, particularly in America, to assess the attitudes of the public to health services. Diagnostic surveys have become an indispensable research weapon.

Surveys are necessary to the development of public health (a) as experimental research to test the relationship of phenomena to circumstances under experimental conditions, e.g., dental caries to water supplies before and after fluoridation, opinions in hospital before and after a change in routine; and (b) as operational research, particularly in the form of descriptive surveys, which provide information essential to the organisation and reorganisation of services. By this means we learn essential details about the old, the handicapped, slum dwellers, pregnant women, to mention but few of the innumerable issues that now affect public health. Multi-purpose surveys, essentially socio-medical, collect information on environmental factors, health activities and services, together with general household inquiries – employment, education, housing, food, consumer goods, transport, etc. Special surveys, more medical in character, examine nutrition, mental disorder, socio-economic conditions, environmental sanitation, etc.; these latter employ professional investigators, as, e.g., a medical team examining prevalent diseases. Surveys now provide one of the great and indispensable public health weapons, to be used increasingly, with experts in other social sciences, as public health extends into the social and anthropological fields.

SICKNESS SURVEYS

Until recent years few surveys were specifically designed for sickness. William Farr suggested, in 1839, that sickness should be studied by taking '100,000 persons of given ages, indiscriminately, and observing them for one, two, three, etc., years',[14] but this idea was never taken up. The censuses in Ireland were used incidentally

for sickness (1851–1911); as also in the U.S.A. Life insurance made studies, e.g., The Metropolitan Life Insurance Company of New York in Montreal (1926); and many were made by public health departments in Europe and the U.S.A. The first large scale survey of all sickness was conducted in the U.S.A. in 1936. In 1965, general morbidity surveys were made in 33 countries; and surveys in selected areas are commonplace.

Sickness surveys may seek information about (a) all illnesses or (b) particular diseases. They can be by (1) interview,[69a] (2) health examinations, (3) surveys of existing records. They can also be categorized as:—

(A) According to population served
- (i) Whole population by household sample
- (ii) Selected area
  - (a) all households
  - (b) sample of households

(B) According to the information sought
- (i) Information about all illness
- (ii) Information about particular illnesses

Combinations of these categories can be devised to meet local conditions and needs.

INTERVIEW SURVEYS

Interview surveys may be either (a) by simple retrospective inquiry or (b) by short-term diary records. This method of morbidity study contends with many difficulties, not least of which for the retrospective inquiry is failing memory, although the measure of error can be calculated. One of the greatest difficulties experienced, both for interviewers and coders, is to distinguish between separate illnesses and multiple symptoms of one illness. Many are inclined to criticize the recording of medical information by lay persons, holding that errors in measuring both general sickness and also specific disease must, in consequence, be considerable. On the other hand, the Interview Survey aims to discover the extent to which people feel themselves to be ill or to have something wrong with them (see p. 2); and this can be done as competently by laymen as by doctors. Much more study of the method is needed before we can know how closely the lay records can correspond with medical diagnoses; but there is evidence to suggest that the results are reasonably accurate: certainly the incidence of diabetes and tuberculosis has been shown

to approximate closely to that calculated using information from other sources.[64 69a]

Interview surveys of the whole population are most suited to developed countries, in view of the need for this purpose, among much else, of a complete population census. Information obtained provides the nearest to complete estimate of total sickness in a community so far obtained. Details vary from country to country and are clearly dependent on social patterns and the organization of health services. In England and Wales the number of medical consultations in the year averaged about 4 per head for each sex up to the age 45, and then increased to 6 at 55–65, and over 7 in advanced age; at all adult ages the average was about 5 visits annually for each sex. Yet out of 46,112 persons who had some illness during the average month of 1947, 39,904 reported no days of incapacity during that month. In other words, only one out of every seven sick people (13½ per cent) was away from work, or confined to the house, on account of illness. Only one in four (23 per cent) of those recording an illness or injury during the month had consulted a doctor during that month. The extent to which incapacity depends upon the job, as much as upon the illness, can be seen by comparing different occupations for both prevalence and incapacity. The prevalence rates of miners did not differ greatly from those of the professional classes; but the incapacity rates were much higher. The much higher loss of working hours among miners than among professional people reflects the difficulties of the miner's life and his attitude. Such glimpses into the vast amount of information yielded by the Sickness Survey, reveal more clearly the significance of ill-health in a community: certainly more than morbidity statistics based solely upon the records of the general practitioner, industry, or the hospital; perhaps 4, 7, and 20 times more, respectively. (For sampling see p. 276.)

Interview surveys limited to selected areas – either by visiting all households or by questioning representative samples – can be used effectively in countries at all stages of development. They are economical; they link morbidity with social conditions; they define population automatically; they are flexible and easily controlled. If using a team, including a doctor, they can build up a complete picture of morbidity, and thus serve, among other purposes, to show to what extent other sources of morbidity, for example, records of absence, of general practitioners' or hospital work, are incomplete. The whole population of an area of say 5,000–10,000 persons may be taken; or alternatively for large areas, after prepara-

tion of house lists, every *n*th house may be selected in proportion to the size of the area. Districts may be selected for their representative character and may need to be changed at intervals.

In countries where the state of development is least, the importance of such surveys is perhaps greatest, as 'one of the most promising methods of obtaining morbidity statistics'.[81] Medical field units in Gambia have remarked upon the advantage to be gained by surveys which serve 'to identify the endemic diseases and to throw light on their relative incidence'. It has been shown that the survey can readily be incorporated into a campaign against a specific disease, for example, yaws'.[72] Household visiting of the whole area – or of a sample within the area – may, in fact, be the only means to obtain full and reliable information of illness. This is the field which is being developed by WHO; studies by households have been conducted in Sweden, India, and Puerto Rico. Special surveys can also be combined with the decennial census in under-developed countries, 'to obtain information on infant mortality in areas for which no data have hitherto been available, or to rectify the register of birth'.[57]

HEALTH EXAMINATION SURVEYS

Physical examinations combined with laboratory and other diagnostic tests can be made in groups large and small, either sampled or in total. These surveys achieve greater diagnostic accuracy; but they are costly, require skilled staff and encounter more resistance. They provide excellent assessments, particularly when combined with interviewing, with which to formulate public health programmes.

SURVEYS OF EXISTING RECORDS

Records of hospitals, of institutions, of medical practitioners, of social insurance agencies, etc., can, as earlier indicated (pp. 261–270), be surveyed for morbidity data.

The sickness survey method requires experience of the sampling theory – unless all households are visited – and of the techniques of field surveys. The analysis of the morbidity data also presents difficulties. One useful expedient is to use the numbers interviewed as the denominator for the rates. The development of sickness surveys – and the necessary expert advice – should be one of the

most important functions of national committees (see p. 227).

A check-list of factors bearing on the design of health interview surveys is given in WHO Technical Report Series No. 218 (1961).

CHAPTER 27

Planning and Conducting the Survey

THE survey needs a director to plan, organise, supervise and finally produce a critical appraisal of the results. His first task is to formulate the plan in detail, jointly with interviewers, advisers and statisticians; to settle the category or categories to be examined, the information to be sought, the means to collect it; the frame from which the sample is to be drawn; the questions, observations and measurements to be made and the standards to be used in classification. *All decisions in the planning sessions, agreed by all parties, should be recorded in detail.* The plan itself should be made available, in sufficient detail, to those concerned, as well as to organisations and individuals likely to be interested in the results. Agreement should be obtained from responsible persons and bodies involved.

The first step is to define the object concisely: what question it is meant to answer, in order to be certain that the study is worthwhile; that there is a community problem which commands attention; that a survey is the best way to find an answer; that the material available is enough to answer the questions; that the answer is not already known. Reading available literature – to learn what other people have done about it, to understand the difficulties, and to arrive at the best method of tackling it – is an indispensable early step.

There follow decisions on the following important matters:

(a) *The categories to be covered by the survey* – population, areas, institutions. There are always some people or areas that cannot be easily reached, migrants or gipsies, for example, so-called marginal types or floating members which may have to be excluded.

(b) *The nature of the information to be collected.* The details will vary greatly, but the general principles are to see that the items of information form a rounded whole; that the questions are all

relevant and capable of explanation to the people interviewed; that there is nothing redundant; that the whole is practicable; that nothing vital has been omitted. The failure to record a mother's age at the birth of the child and the total children born were serious omissions in the 1921 and 1931 censuses in Britain.

(c) *The methods of collecting information.* These will depend upon the subject and the type of information required. A decision has to be taken on what is to be done about those who do not respond.

(d) *The frame to be used.* Frames can be inaccurate, incomplete, subject to duplication, inadequate, or out of date. In practice most frames suffer to a greater or less extent from all these defects. Most suffer from incompleteness in some respect, as, for example, where a list describes some married women as single, which makes it incomplete for single women, although complete as a frame for women as a whole. Incompleteness of the frame is more serious than at first appears, because it is in the missing units that special characteristics are often to be found, as in mass radiography studies of tuberculosis. At the outset of the survey a careful investigation should be made of any frame it is proposed to use.

(e) *The questionnaire.* The exercise of imagination is needed in order to devise questions that are able to produce the answers that are wanted. A pre-test with selected people will help to understand what the questions are yielding.

When properly designed the questionnaire provides the means of recording facts directly in the form of categorised data. Since the ultimate integrity of the research depends upon the validity of the data which the questionnaire produces, it has to be drawn up with care and forethought. All questions must be capable of definite interpretation by the respondent and for the interviewer. Questions posed without due consideration may be ambiguously worded; they can be worded in such a form as to cause bias; they can be vague or incomplete; they can embarrass and so lead to evasion; they can be too general, too unprecise; or, only too often, sadly although vital to success, they can be forgotten or omitted. Ambiguity is a frequent sinner, as examination candidates will readily agree. Of this the census carried out in 1801 for England and Wales is a nice example. To learn something about numbers employed in various occupations, the question was put 'What number of persons in your parish, township, or place, are chiefly employed in agriculture; how many in trade, manufacture, or handicraft; and how many are not comprised in any of the preceding classes?' 'Chiefly

employed' was an ambiguous term, which might or might not include wives and children; in the result, the data from the question had to be completely ignored and the inquiry in this respect was null and void. Total omission of vital questions is likewise a frequent and much to be deplored hazard. Thus, in the Stockport Survey of over eighties questions were put about visits from relatives; but no questions were asked about the degree of their proximity, thus making it impossible to gauge what differences existed in visiting by relatives of various degrees of proximity in differing home-backgrounds.[3b] Beware, too, of vagueness. 'How are you feeling?' can mean different things to different people.

The interviewer should record his or her own observations in a space provided; these may not lend themselves to exact analysis, but can point to relevant facts not covered by the questionnaire. The questionnaire should be pruned to remove all questions not absolutely needed. Temptation to overload questionnaires should be strenuously resisted in the interests of both economy and accuracy. There is a definite limit of usefulness of the material sought; we pass this at our peril.

Questionnaires may be *structured*, i.e. consisting of direct questions to which the answer yes or no can be given, e.g. 'is your job clerical?' or where there are alternatives to be tested, e.g. 'is your job that of a clerk, farmer, shop assistant?' Or they may be *unstructured*, consisting of open-ended questions designed for answers which elaborate and may be discursive, e.g. 'what is your occupation?' Open-ended questions suffer from lack of standardisation, so that replies about the same occupation, e.g. may be variously interpreted. They may be *independent*, i.e. separately interpreted or they may be *interdependant*, i.e., taken together for interpretation. A number of interdependant questions taken together can often give a better insight into behaviour than any single question. Thus in an inquiry of female patients on the list of the University Health Centre, Manchester, knowledge about cancer of the cervix was asked in six different questions (1, 3, 7, 19, 20, 22). Six replies were then ranked in order of correctness, six correct being very good, five correct good, three correct low, one correct very low. Interdependant questions also help to check accuracy. In the above study, e.g., questions about the preventability of cancer differently couched produced contradictory answers, indicating that respondents had not understood, or did not have a clear view of the meaning of 'preventability'.[3d]

Extraneous factors may influence replies and so distort the truth;

some in the mind of the person questioned and others involving the interviewer. Respondents may have their status in mind, as when being asked whether they drink beer, the reply is 'no, whisky', if they regard whisky drinking as socially more desirable. Desire to please may lead to answers which it is supposed the interviewer or the questionnaire wish to record; 'do you give your husband a hot meal every day?' may get the answer yes more frequently than in fact is the case. Interviewers can ask questions with inflections, so that the same question by different interviewers gets different answers. The sequence of questions is important because of the influence which it may have on the respondent. Lack of order or sequence tends to confuse or build up resistance and questions on the same topic are better grouped. Yet lack of order is often necessary to avoid suggestion by influence, or to insert questions about the same subject more than once. Thus it is that drawing up the questionnaire can be a long, arduous and often frustrating task.

Questions may be asked by post or by interview or by both. The advantages and disadvantages of postal inquiries and personal interrogation are much debated. The choice will depend most upon the circumstances and nature of the survey. Anonymity is sometimes of greater importance than the more reliable information generally to be obtained by interview, since many who willingly tick a document are reluctant to answer questions to a person's face. An interview gives the opportunity to explain and to amplify and thus may avoid errors and inconsistencies, which would have occurred by misunderstanding or ignorance of a term or phrase, or because of latent ambiguity; when questions are answered without understanding the results are worse than no information at all. Interviews take time and cost more. They more commonly require technical knowledge – although this is not true of all survey work – in order correctly to put questions and to interpret answers. Apart from technical knowledge, generally resting in a professional qualification, there is the need for careful briefing. Even highly qualified persons must fully understand the aspects and methods of the survey if they are to discuss questions with respondents and correctly interpret replies. Interviewing imposes considerable strain, since it involves an intellectual synthesis and evaluation of a wide range of replies from people of varying capacity. *All information obtained at interview should be written down in its final form at the time of the interview.*

(f) *Interviewers.* The amount which each interviewer can do varies with the area to be covered, the time spent in travel, and the

nature of the inquiry – perhaps seven completed questionnaires a day. Interviewers should preferably have a background knowledge of the subject, particularly in investigations of the research type. But in multi-type surveys unspecialized teams of workers can be used, provided that no observations or measurements are needed which depend on special skills, and that the interpretation of the questionnaire is well understood. Briefing is of the greatest importance, and every interviewer should understand what the survey is intended to achieve.

(g) *A pilot study* can be conducted on a small but representative group, preferably, but not necessarily, out of the area covered. The results can show whether questions are being understood; whether they tend to bias the answer; whether they are ambiguous, unnecessary, vague, embarrassing; or any other deadly sins. It may help to find missing questions. It can tell something about the variables we are seeking to measure; can be used to test the questionnaire; to train staff; to assess costs; and to judge the type of sampling unit.

(h) *Drawing the sample,* including the control, is an increasingly important element in a survey. Nevertheless it is not always essential; surveys can tackle the whole of a group, or in certain cases an incomplete group, in which the missing members are well documented. Apart from this, surveys can deal with any group of persons providing the findings are limited to the group in question; many excellent surveys of this kind have been done in recent years. But if a sample is drawn it must be representative of the group and free from bias. Apart from the obvious dangers of selection, there are many hidden sources of error; a group of mothers attending the welfare centre is self-selected. In case of doubt checks should be made. Stratification of the sample sometimes helps to make it more representative of the area (see p. 275) and multi-phase sampling allows of considerable precision at a small cost (see p. 275).

(i) *Handling data.* Data can be analysed direct from the forms, transferred to ordinary cards, to cards with holes round the edges (Cope-Chat), to Hollerith or Powers-Samas cards (punched cards) or to computers. Plain cards are sorted entirely by hand, Cope-Chat gives some aid to hand sorting, and the punched card permits mechanical sorting. Direct analysis and the use of ordinary cards for hand sorting can yield excellent results, providing there is a simple format with rigorous and continuous scrutiny of incoming forms. For small studies, or in the case of material slowly accumulating, the Cope-Chat card for hand use can be effective; otherwise the

Hollerith or its 'equivalent' should be used. The Hollerith card has 80 columns, each with 12 different entries; the punching machine enters like a typewriter. There is one card for each individual, or more if questions exceed 80. The method to be adopted depends on the size and nature of the study and must be settled in consultation with the statistician. Where cards are to be punched, pre-coding of the questionnaire is desirable. All questions can be coded where the answers fall under the limited number of heads, for example:

Age in years	18 – 24	1	45 – 54	4
	25 – 34	2	55 – 64	5
	35 – 44	3	65 & over	6

The answers to many questions cannot easily be coded, as in opinion surveys – Why did you become a nurse? These will have to be studied by the surveyor and written as illustrations into his analysis. But if questions excluded in the first place from coding can be seen to be producing a sufficiently steady pattern of reply – these should then be coded.

The principal drawback of simple punched card machines is their limited arithmetical capability, so that calculations of rates, percentages and tests for validity need to be done with monotonous repetition by hand, or on calculators.

An automatic sequence controlled calculator, which followed the mechanical principles evolved by Charles Babbage in the 19th century, was first successfully constructed at Harvard in 1944. The electronic calculating machine came in 1946; first using the thermionic valves, it has since improved steadily with transistors and integrated circuits in both speed and reliability.

The *computer* has much to commend it, particularly for large scale studies. It is capable of storing a programme of instructions with which it can proceed step by step at very high speed. 'Programmes', initially costly in time, money and skilled professional labour, but ultimately, by repeated use both locally and through telelinkage from a distance, economical in all these respects, can be prepared for all the analyses previously discussed. Data can be fed in on tape (magnetic or paper) and on punched cards of various kinds.

The computer can handle data of great complexity; perform statistical exercises otherwise impossible except as a 'tour de force'; keep basic files for individuals; link records relating to the same person; record in detail departures from health, operative and therapeutic data of considerable complexity; sift and scan data to detect significant relationships and unusual trends, as in the incidence of congenital malformations; check records for consistency,

immediately listing unsatisfactory returns; calculate rates, standardizations and indices; store data for subsequent processing and for the preparation of indexes; perform laboratory analyses; prepare schedules of individuals or items currently in need of attention as, e.g., schedules of children to be immunized with letters issued to physicians or clinics.

Such a wide range of functions can help greatly in epidemiology and vital and health statistics. Punched cards can be discarded after input, providing care is taken to store magnetic tapes in dust and magnetic free conditions. With improving apparatus, better understanding of requirements and education of potential users, the computer will increasingly become an indispensable aid to data collection and analysis.[7a 4a]

CHAPTER 28

The Presentation of Data

THE basic considerations in the presentation of data are those which govern its collection – namely, accuracy, consistency, and thoroughness. But there are other and more subtle attributes which arise from the inherent difficulties of expressing scientific, and indeed all philosophic, matter in words, which can be great deceivers. Words must be honestly employed, i.e., with their meaning unambiguously clear and definite; and they must be understood by the writer and be understandable by the reader in their full significance. The elimination of jargon and a clear and logical sequence of thought are among the first essentials. When simplicity has been achieved in the spoken or written presentation, the result is likely to please everyone, uninformed and informed alike.

The chief considerations governing the actual presentation of data are as follows:—

1. The *basic documents,* which give the results of the analysis in full, generally in the form of gross data (the protocols), should if possible be published. Unless this is done research workers, either present or future, cannot examine the validity of the conclusions, or re-examine the material from other points of view. Copies of all the important forms used, e.g. questionnaires, should be published. These basic documents will best appear in appendices.

2. Data should be *clearly, concisely* and *precisely* set out. This is easier to prescribe than to carry out, since the three attributes are in some measure in conflict. Tables and graphs often succeed in being both concise and clear only through the *sacrifice* of detail; whereas precision too often can be achieved only through the *use* of detail. It is not easy, at one and the same time, to achieve clarity and to present material concisely without sacrificing precision; and vice versa. The publication of protocols in full, while leaving the writer free to simplify in tables and graphs, does something to answer the call for precision; but in the end only the most rigorous scrutiny can ensure that tables and graphs have not been over-simplified, or alternatively are not so detailed as to be unintelligible.

3. *Tables* should as far as possible be small and simple. They should be headed to describe their contents clearly and precisely; with similar descriptive subheadings for rows and columns. The accepted formula for such headings is to give (1) subject, (2) distribution, (3) place and (4) time in that order. The source of information can be given, where necessary, in a footnote; and footnotes are also proper for explanations of abbreviations, terms and unusual entries. The matter in the tables should be arranged to suit the convenience of the reader, generally by logical or convenient sequences and groupings. Data should be given so far as possible in whole numbers or to a single place of decimals, especially when the reliability of the sources of information is questionable. Good tabular presentation is in consequence an art for which advice is needed from both statistician and printer. Tables can be produced, with modern tools, with great ease. Fed by means of a programme into a computer, basic data is transformed into tables in the twinkling of an eye. Any relationship can be reduced by coding and programming at the speed of thought; so that proliferation of tables itself becomes a problem. The machine will also perform all or most essential statistical calculations, *standard deviations, coefficient of correlation* and other statistical checks upon validity. Tables can thus be equipped with indices, indicating the extent to which the particular association could have occurred by chance; the *probable or standard* error to help in evaluating differences in measuring the same value in different circumstances; and the *standard deviation* to guide the reader as to the importance to be placed upon averages. Thus if the statistican has prevented the use of biased or unrepresentative samples and oversmall groups likely to give chance results, the informed reader will have everything to hand with which to reach

his own conclusions about the results. It follows that the chief difficulties of presenting data begin *after tabulation* and consist for the most part of questions involving judgment and discrimination – abstract values outside the scope of mechanical instruments. Some of these difficulties, prone to result in bias, will be dealt with in the next section.

4. *Graphs*, which aim to convey information at a glance, can do much to show clearly and concisely the most important findings. They also serve to demonstrate the existence of cyclical variations, which would not otherwise easily be seen to exist, and which call for further investigation. They may be in the form of line charts, bar diagrams, maps, pie diagrams and correlation diagrams; as well as various ways of illustrating material by the use of pictures, sketches and quotations. Of these the most commonly used are the line charts which show variations in indices or quantities measured (on the vertical) against time in seasons, age or years (on the horizontal). *Bar diagrams*, or *histograms*, show variations in indices or quantities by means of bars proportional in length to their magnitude. The bars can be drawn horizontally from the vertical or vertical from the horizontal; they may be measured against time, place, age, etc. *Maps* can be used for the obvious purpose of showing the topographical features of a geographical area; or as another substitute for the table by showing values in terms of distinctive shading; or by the use of dots proportional to the events recorded. *Pie diagrams* are a simple device to show proportional variations by dividing a circle into sectors, each sector being proportional to the quantities (usually percentages) of the constituent categories. Finally, *correlation diagrams* use individual dots to record magnitude of individual events, measured as to size on the vertical and in terms of a specific factor on the horizontal. The correlation diagram then is basically the same as the line chart but with no attempt to connect the individual dots one to another. When the dots do tend to fall on a line, or to form a pattern, a correlation probably exists between the specific factor and the magnitude of the recorded event. Thus the dots indicating infant mortality in relation to communities living at different densities will fall upon a line with mortalities increasing with congestion of living.

Tables and graphic representations of particular aspects of the subject, as distinct from the protocols previously mentioned, should appear in the body of the report, *accompanied by an explanation in the text*. No tables should be allowed to appear without forming part of the narrative.

5. *Avoiding Bias.* Our interest in classification lies in its value as a philosophic and generalising instrument. Tabulation, graphic representation and statistical analyses aim to find *distinguishing characteristics*; and help in the search for *uniqueness* in the data which can provide at least the starting point for new knowledge. The next logical step is to distinguish characteristics and relationships which appear to be 'unique'; to try to extract their full meaning. This calls for the setting up and, if necessary, knocking down of *hypotheses*. Discussion and comment will lead on to recommendations. In presenting data there is the danger of bias, either verbal or graphic.

Verbal bias. This error of interpretation arises when the writer states or infers a causal relationship to exist, when an association has been shown without any evidence as to cause and effect. This has been styled the 'post hoc' fallacy, since 'statistically significant' relationships can be post hoc and not necessarily propter hoc; the relationship may be due to both variables being related to a third known or unknown variable. Decrease in tuberculosis in Western Europe has been correlated with increasing sugar consumption, a factor which has had no causal relationship with the decline. Both the decline and the increase of sugar consumption are related to one or more outside factors, better housing, better medical services, better diet, etc. On the other hand statistically significant correlations can be due to cause and effect (as almost certainly the case with smoking and carcinoma of the lung). Verbal bias also arises from misinterpretation and misuse of a variety of simple mathematical calculations; particularly proportions and averages. Two children possess I.Q.'s of 98 and 101 respectively, with the inference that one is necessarily that much more intelligent than the other. But the probable error in the calculation can make any such inference false; in the Binet-Simon test the error may be taken to be 3%, enough to give a one in four chance that the I.Q.'s of the two children could in fact have been reversed. In the case of averages, the *median* and the *mode* can differ from each other and from the *arithmetic mean*. Failure to make it clear what kind of average you are using, or to use one sort at one moment and another kind at another moment, can literally make nonsense of any presentation of data.* The standard deviation

* The *arithmetic mean* is obtained by adding up all the examples and dividing by the number there are. The *median* is the example in the middle with an equal number above and below. The *mode* is the example which occurs most frequently.

which gives an idea of what emphasis can be placed upon any average, is too often ignored. When those attending V.D. clinics vary in age from 15 to 55, the mode (say age 18) conveys something important; the median (say age 22) conveys less; and the arithmetic mean (say age 28) conveys little. In the case of decimals it is possible to give a false impression by overuse. Accuracy cannot in any case transcend that of the original observations from which the calculations were made; if these were not impeccable, results given to one or more decimal places are misleading.

Graphic bias. Distortion or manipulation of graphs, maps and other devices to present data in easily comprehensible form is by no means uncommon; although generally found in journals or advertisements which have no claim to scientific integrity, the public health worker should none the less be aware of this hazard. Maps can distort facts and give false impressions by manipulating the shading without due regard for the comparability of the areas shaded. Graphs can be truncated by chopping off the bottom, so that the line on the chart cannot be seen in relation to zero; or the proportion of either the vertical or the horizontal measurements can be altered to produce exaggerated effects. Pictures can be used to demonstrate differences in one measurement, when in fact they differ in two measurements. If, e.g., two pictures are used to present an object, one can be made to vary both in height and in width and will thus have grown geometrically not arithmetically – if twice as high and twice as wide it will appear four times as large.

(j) *Writing the report.* A good report will detail the nature of the inquiry in a *preface* and will have section or chapter headings that stimulate interest and arrest attention. It will give an exact description of the material – the geographic region and the categories – as well as the nature of the information collected, the method of collecting data, the sample, the date or period of time to which the data refer, the degree of accuracy, cost, an assessment of fulfilment, and the name of the responsible organization.[49] It will set out the objectives, methods, results, and conclusions, with a bibliography and list of references. Appendices can be used for tables and detailed matters which have formed the basis of the study, but which are not immediately necessary for the reading matter. Tables which are to be discussed should generally appear in the body of the report itself and be interpreted in the text. An account of previous investigations of the same or allied subjects should be set out in the preface, or in the first section or chapter.

Many of the great pioneer surveyors have achieved their end

more by the skill with which they have written the report of their studies than by the work itself. These great minds have not scorned to dwell at length upon the arts and finesses of writing readable matter. For those who write in English 'Plain Words' by Ernest Gowers is a useful guide to simplicity and clarity. When genius is missing, hard work and the use of plain words can do much to simulate it.

CHAPTER 29

The Statistical Needs of Under-developed Countries

THE NEED TO HASTEN SLOWLY

THE dilemma of under-developed countries has to be faced. National systems of comprehensive vital and health statistics must take many decades to achieve. Indeed, since existing systems in technically advanced countries have grown by long and painful processes, dependent largely upon the particular types of culture, there is no certainty that they could be achieved in less developed countries. Western processes, greatly accelerated, may not easily be impressed upon peoples whose social pattern is based upon different cultural values.[63]

Registration is a case in point. Absence of compulsory registration has often been blamed[13] for lack of vital statistics; but even where registration exists, as in Malaya and parts of India, 'failure to enforce the law against defaulters has resulted in no material improvement being effected in such areas',[32] and in those areas where registration succeeds, at least partly, the information may be inaccurate and misleading. Registration of death is easier to enforce where permission for burial is made dependent upon it, but, as we have already seen, compulsory registration of births follows naturally only upon some need for documentary evidence as, for example, rationing in Malaya in World War II; it may have to wait upon school systems and upon other personal interests. The obstacles to the development of comprehensive systems are in fact much more fundamental. They include absence of government, particularly at the local level, and the lack of professional persons – physicians, midwives, nurses, and sanitarians. Illiteracy and

indifference of large sections of the population prevent any real understanding of the part each has to play. Ignorance and poor communications hamper co-operation with officials. Local traditions and customs impede the introduction of new ideas or stultify their operation.

Despite the great need for reliable information upon which to build health services and with which to satisfy international organizations, vital and health statistics provide an instance where more haste may mean less speed. Edge has said:[11]

> 'Any attempt to carry out specific enquiries in the interest of public health, or to introduce systems of human book-keeping among a people having no previous experience of works of this kind, should start with the intention of hastening slowly, and with the determination that so far as is humanly possible, schemes of work will follow along lines not too far removed from local custom so that their purpose may be understood. . . . Legislative measures providing for the introduction of reformative schemes may be framed with ease, but it is sometimes forgotten that unless the requirements such enactments desire to implement are likely to receive the approval of local public opinion, they may prove inoperative.'

Success in this field comes only with cultural change following on economic development and prolonged health education.

The means of meeting these, and many other difficulties, are not easy to find, and certainly will not be the same in any two countries. In general, they are those outlined in Part Six of this book; but it may serve a useful purpose to recapitulate and extend them in terms of the under-developed world (areas of Types A and B).

THE TRAINING OF STATISTICAL STAFF

The development of vital and health statistics cannot take place without at least a nucleus of skilled staff to plan the operation and to train others. Statistics as a separate subject is being taught in most universities, almost throughout the world. It is the adaptation of statisticians to vital and health statistical work that is needed. In under-developed countries this essential step often cannot be taken without outside aid.

Those countries that have developed statistical services, therefore, can help by admitting 'fellows' for training in their own departments, and by sending experts to seminars and training centres abroad. The World Health Organization and the United Nations have both collaborated with various governments in such ventures. Seminars have been held at Santiago, Chile (1950), and at Tokyo (1952), and training centres in Ceylon (1951), Cairo

(1951), Afghanistan (1954), Fiji (1962), and Bangkok (1965). A permanent Inter-American Centre of Biostatistics has been set up at Santiago. Those so far trained – a few hundreds supplemented by a few dozen fellows – are providing the nucleus, in many outlying parts, around which statistical systems are being built.

THE ESTIMATION OF POPULATION

The second fundamental need is for an estimate of population, without which the calculation of mortality, natality, and morbidity rates, and indeed the interpretation of the significance of most observations in the health field, depends. A regular census to determine how many people of each sex are living at different ages must rank high in any programme of vital and health statistics. The first international conference of national committees recommended a detailed census at ten-yearly intervals; but a five-yearly census, at least for age, sex, marital status, and occupation, will be needed in all countries where there is much internal migration. Unfortunately internal migration is a marked feature of all under-developed countries, once the process of development begins in earnest (see p. 81), and such movements of population can vitiate the most painstaking recording. Even the relatively simple movements of expectant mothers to other localities for confinement, to seek better medical care or for other reasons, can introduce serious errors, as in mortality rates where the infant dies soon after birth.

Intercensal estimates of population, therefore, are of even greater importance in under-developed areas – often without the ready access to usual details of births, deaths, and migration – than they are in developed areas. This means that alternatives have to be found, such as sampling, or the selection of special areas for study. The sample survey mentioned earlier and described more fully in the handbook of Population Census Methods[21] and in the United Nations Commissions on Surveys and Sampling,[49] together with other major developments, including staff training, made during the last few years, have enormously increased the practicability of census taking. For details to be included in the census see p. 218.

BIRTH REGISTRATION

Thirdly, although some form of birth registration, compulsory or otherwise, is relatively easy to get, nevertheless the totals obtained in this way rarely make satisfactory denominators for calculating infant mortality, without careful checks. Midwives, registrars, and

others concerned in reporting should be aware of the standard definitions of live births. Late foetal deaths (stillbirths) should be registered particularly in order to avoid the inevitable failure to record those dying soon after birth, also to make it possible to calculate the ratio of still to live births.

It is better to limit the data tabulated in registration to a minimum than to overload a weak machinery (see Chapter 23). Greater refinement in registration of births should, however, make possible records of plural births and of legitimacy – if penalties and disabilities in the social code do not make this undesirable, and where legitimacy is subject to simple definition. Many other refinements, for example, the age of the mother, duration of marriage, and numbers previously born alive, which are valuable for fertility studies, can be provided only in model areas, or through sample studies. Sample surveys can be most valuable (see p. 274).

THE CALCULATION OF MORTALITY AND MORBIDITY

The classification of causes of death should never be too ambitious. Where medical auxiliaries or laymen are used in making returns of death, a classification even simpler than the official abbreviated lists may be devised similar to that drawn up by the African Seminar on vital and health statistics held at Brazzaville (1956) (See Appendix VI).[56] Where a medical certificate is available, either from a general practitioner who attended the deceased before death, or from the public health officer, who comes to the best conclusion possible on the evidence available, the International List of 150 causes is probably most appropriate. Generally a single cause, the underlying cause (see p. 229), only should be given – certainly if the person certifying is other than a general practitioner, who attended the deceased in his last illness.

The determination of numerators and denominators for infant mortality is subject to many errors. One means to meet this difficulty is the calculation of rates over the first three-year span, although this has no international backing. A local card index of all children born, subjected to continual checks by whatever agencies are working in the field, including, where they exist, teachers, health visitors, or health assistants, provides the framework. This should result, over a period of time and with local enthusiasm, in an estimate of child survival more accurate than the standard infant mortality calcula-

tions, and one at the same time which is equally valuable as a comparative index of healthiness.[63]

For morbidity data the main weapon in under-developed countries should be the survey, particularly 'ad hoc' surveys seeking specific, rather than general, information. Otherwise some help will be obtained where a school system exists, although rates only can be calculated for the highly selected school child population, using the school register as the denominator. Health centres, special treatment centres, and notification, will all be of value for easily recognizable diseases. Hospital data, with all their limitations (see p. 265), can provide valuable morbidity data in developing countries and efforts to simplify and improve methods of recording in hospitals can be rewarding.

MODEL AREAS

Lastly, model areas, in which registration and the development of public health practice along model lines go hand in hand, should be of general application. Each such area of approximately 40,000–100,000 population should operate both as a local health unit – with nurses, midwives, and sanitarians working from health centres – and as a model registration area, with the technicians trained in vital statistical methods. The area should be directed by a medical officer of health with special training in public health work. A concentration of effort with skilled staff in a relatively small area is of inestimable value in learning what are the main obstacles to be overcome in obtaining vital and health statistics, as well as in providing a valuable check for the remainder of the country. In model areas it becomes possible to obtain complete recording of live births and deaths at all ages. The card index already suggested can be maintained and the conduct of a census is relatively easy. Morbidity surveys are possible. General and specific death rates can be determined, together with data about the incidence and prevalence of the main diseases, which will serve as indices of unhealthiness in different parts of the country. The model area provides an admirable training ground for all types of staff in the significance of statistics to public health work. It can be a first step, the most difficult of all, on the long road to an adequate health infrastructure (see pp. 163–167).

Conclusion

OUR world tour is over and every reader is back in his homeland – the best in the world; if a little wiser, less complacent, and more aware of the world-wide issues from which no country can now stand aloof, then these words have served their purpose.

> If a man will begin with certainties, he shall end in doubts; but if he will be content to begin with doubts, he shall end in certainties.
>
> BACON[3]

APPENDIX I

LIST A—*List of 150 Causes for Tabulation of Morbidity and Mortality*

			Detailed List Numbers
A	1	Cholera	000
A	2	Typhoid fever	001
A	3	Paratyphoid fever and other Salmonella infections	002, 003
A	4	Bacillary dysentery and amoebiasis	004, 006
A	5	Enteritis and other diarrhoeal diseases	008, 009
A	6	Tuberculosis of respiratory system	010–012
A	7	Tuberculosis of meninges and central nervous system	013
A	8	Tuberculosis of intestines, peritonaeum and mesenteric glands	014
A	9	Tuberculosis of bones and joints	015
A	10	Other tuberculosis, including late effects	016–019
A	11	Plague	020
A	12	Anthrax	022
A	13	Brucellosis	023
A	14	Leprosy	030
A	15	Diphtheria	032
A	16	Whooping cough	033
A	17	Streptococcal sore throat and scarlet fever	034
A	18	Erysipelas	035
A	19	Meningococcal infection	036
A	20	Tetanus	037
A	21	Other bacterial diseases	005, 007, 021, 024–027, 031, 038, 039
A	22	Acute poliomyelitis	040–043
A	23	Late effects of acute poliomyelitis	044
A	24	Smallpox	050
A	25	Measles	055
A	26	Yellow fever	060
A	27	Viral encephalitis	062–065
A	28	Infectious hepatitis	070
A	29	Other viral diseases	045, 046, 051–054, 056, 057, 061, 066–068, 071–079
A	30	Typhus and other rickettsioses	080–083
A	31	Malaria	084
A	32	Trypanosomiasis	086, 087
A	33	Relapsing fever	088

A 34	Congenital syphilis	090
A 35	Early syphilis, symptomatic	091
A 36	Syphilis of central nervous system	094
A 37	Other syphilis	092, 093 095–097
A 38	Gonococcal infections	098
A 39	Schistosomiasis	120
A 40	Hydatidosis	122
A 41	Filarial infection	125
A 42	Ancylostomiasis	126
A 43	Other helminthiases	121, 123, 124 127–129
A 44	All other infective and parasitic diseases	085, 089, 099 100–104, 110–117 130–136
A 45	Malignant neoplasm of buccal cavity and pharynx	140–149
A 46	Malignant neoplasm of oesophagus	150
A 47	Malignant neoplasm of stomach	151
A 48	Malignant neoplasm of intestine, except rectum	152, 153
A 49	Malignant neoplasm of rectum and rectosigmoid junction	154
A 50	Malignant neoplasm of larynx	161
A 51	Malignant neoplasm of trachea, bronchus and lung	162
A 52	Malignant neoplasm of bone	170
A 53	Malignant neoplasm of skin	172, 173
A 54	Malignant neoplasm of breast	174
A 55	Malignant neoplasm of cervix uteri	180
A 56	Other malignant neoplasm of uterus	181, 182
A 57	Malignant neoplasm of prostate	185
A 58	Malignant neoplasm of other and unspecified sites	155–159, 160, 163 171, 183, 184 186–189, 190–199
A 59	Leukaemia	204–207
A 60	Other neoplasms of lymphatic and haematopoietic tissue	200–203, 208 209
A 61	Benign neoplasms and neoplasms of unspecified nature	210–239
A 62	Non-toxic goitre	240, 241
A 63	Thyrotoxicosis with or without goitre	242
A 64	Diabetes mellitus	250
A 65	Avitaminoses and other nutritional deficiency	260–269
A 66	Other endocrine and metabolic diseases	243–246, 251–258 270–279
A 67	Anaemias	280–285
A 68	Other diseases of blood and blood forming organs	286–289
A 69	Psychoses	290–299
A 70	Neuroses, personality disorders and other non-psychotic mental disorders	300–309
A 71	Mental retardation	310–315
A 72	Meningitis	320
A 73	Multiple sclerosis	340
A 74	Epilepsy	345
A 75	Inflammatory diseases of eye	360–369
A 76	Cataract	374

A 77	Glaucoma	375
A 78	Otitis media and mastoiditis	381–383
A 79	Other diseases of nervous system and sense organs	321–324, 330–333 341–344, 346–349 350–358, 370–373 376–379, 380 384–389
A 80	Active rheumatic fever	390–392
A 81	Chronic rheumatic heart disease	393–398
A 82	Hypertensive disease	400–404
A 83	Ischaemic heart disease	410–414
A 84	Other forms of heart disease	420–429
A 85	Cerebrovascular disease	430–438
A 86	Diseases of arteries, arterioles and capillaries	440–447
A 87	Venous thrombosis and embolism	450–453
A 88	Other diseases of circulatory system	454–458
A 89	Acute respiratory infections	460–466
A 90	Influenza	470–474
A 91	Viral pneumonia	480
A 92	Other pneumonia	481–486
A 93	Bronchitis, emphysema and asthma	490–493
A 94	Hypertrophy of tonsils and adenoids	500
A 95	Empyema and abscess of lung	510, 513
A 96	Other diseases of respiratory system	501–508, 511 512, 514–518
A 97	Diseases and conditions of teeth and supporting struct	520–525
A 98	Peptic ulcer	531–533
A 99	Gastritis and duodenitis	535
A100	Appendicitis	540–543
A101	Intestinal obstruction and hernia	550–553, 560
A102	Cirrhosis of liver	571
A103	Cholelithiasis and cholecystitis	574, 575
A104	Other diseases of digestive system	526–529, 530 534, 536, 537 561–569, 570 572, 573, 576 577
A105	Acute nephritis	580
A106	Other nephritis and nephrosis	581–584
A107	Infections of kidney	590
A108	Calculi of urinary system	592, 595
A109	Hyperplasia of prostate	600
A110	Diseases of breast	610, 611
A111	Other diseases of genito-urinary system	591, 583 595–589, 601–607 612–616, 620–629
A112	Toxaemias of pregnancy and the puerperium	636–639
A113	Haemorrhage of pregnancy and child-birth	632, 651–653
A114	Abortion induced for legal indications	640, 641
A115	Other and unspecified abortion	642–645
A116	Sepsis of child-birth and the puerperium	670, 671, 673

A117	Other complications of pregnancy, child-birth and the puerperium	630, 631 633–635, 654–662 672, 674–678
A118	Delivery without mention of complication	650
A119	Infections of skin and subcutaneous tissue	680–686
A120	Other diseases of skin and subcutaneous tissue	690–709
A121	Arthritis and spondylitis	710–715
A122	Non-articular rheumatism and rheumatism unspecified	716–718
A123	Osteomyelitis and periostitis	720
A124	Ankylosis and acquired musculo-skeletal deformities	727, 735–738
A125	Other diseases of musculo-skeletal system and connective tissue	721–726, 728 729, 730–734
A126	Spina bifida	741
A127	Congenital anomalies of heart	746
A128	Other congenital anomalies of circulatory system	747
A129	Cleft palate and cleft lip	749
A130	All other congenital anomalies	740, 742–745 748, 750–759
A131	Birth injury and difficult labour	764–768, 772
A132	Conditions of placenta and cord	770, 771
A133	Haemolytic disease of newborn	774, 775
A134	Anoxic and hypoxic conditions not elsewhere classified	776
A135	Other causes of perinatal morbidity and mortality	760–763, 769 773, 777–779
A136	Senility without mention of psychosis	794
A137	Ill-defined and unknown causes of morbidity and mortality	780–793, 95 796
AE138	Motor vehicle accidents	E810–823
AE139	Other transport accidents	E800–807 825–845
AE140	Accidental poisoning	E850–877
AE141	Accidental falls	E880–887
AE142	Accidents caused by fires	E890–899
AE143	Accidental drowning and submersion	E910
AE144	Accident caused by firearms weapons	E922
AE145	Accidents mainly of industrial type	E916–921 923–928
AE146	All other accidental causes	E900–909 911–915, 929 930–936, 940–949
AE147	Suicide and self-inflicted injury	E950–959
AE148	Homicide and injury purposely inflicted by other persons; legal intervention	E960–979
AE149	Injury undermined whether accidentally or purposely inflicted	E980–989
AE150	Injury resulting from operations of war	E990–999
AN138	Fracture of skull	N800–804
AN139	Fracture of spine and trunk	N805–809
AN140	Fracture of limbs	N810–829
AN141	Dislocation without fracture	N830–839
AN142	Sprains and strains of joints and adjacent muscle	N840–848
AN143	Intracranial injury (excluding those with skull fracture)	N850–854

AN144	Internal injury of chest, abdomen and pelvis	N860–869
AN145	Laceration and open wound	N870–908
AN146	Superficial injury, contusion and crushing with intact skin surface	N910–929
AN147	Foreign body entering through orifice	N930–939
AN148	Burns	N940–949
AN149	Adverse effects of chemical substances	N960–989
AN150	All other unspecified effects of external causes	N950–959, 990–999

APPENDIX II

LIST B—*List of 50 Causes for Tabulation of Mortality*

B 1	Cholera	000
B 2	Typhoid fever	001
B 3	Bacillary dysentery and amoebiasis	004, 006
B 4	Enteritis and other diarrhoeal diseases	008, 009
B 5	Tuberculosis of respiratory system	010–012
B 6	Tuberculosis, other forms, including late effects	013–019
B 7	Plague	020
B 8	Diphtheria	032
B 9	Whooping cough	033
B10	Streptococcal sore throat and scarlet fever	034
B11	Meningococcal infection	036
B12	Acute poliomyelitis	040–043
B13	Smallpox	050
B14	Measles	055
B15	Typhus and other rickettsioses	080–083
B16	Malaria	084
B17	Syphilis and its sequelae	090–097
B18	All other infective and parasitic diseases	Rest of 000–136
B19	Malignant neoplasms, including neoplasms of lymphatic and haematopoietic tissues	140–209
B20	Benign neoplasms and neoplasms of unspecified nature	210–239
B21	Diabetes mellitus	250
B22	Avitaminoses and other nutritional deficiency	260–269
B23	Anaemias	280–285
B24	Meningitis	320
B25	Active Rheumatic fever	390–392
B26	Chronic rheumatic heart disease	393–398
B27	Hypertensive disease	400–404
B28	Ischaemic heart disease	410–414
B29	Other forms of heart disease	420–429
B30	Cerebrovascular disease	430–438
B31	Influenza	470–474
B32	Pneumonia	480–486
B33	Bronchitis, emphysema and asthma	490–493
B34	Peptic ulcer	531–533
B35	Appendicitis	540–543
B36	Intestinal obstruction and hernia	550–553, 560
B37	Cirrhosis of liver	571
B38	Nephritis and nephrosis	580–584

B39 Hyperplasia of prostate	600
B40 Abortion	640–645
B41 Other complications of pregnancy, child-birth and the puerperium. Delivery without mention of complication	630–639, 650–678
B42 Congenital anomalies	740–759
B43 Birth injury, difficult labour and other anoxic and hypoxic conditions	764–768, 772 776
B44 Other causes of perinatal mortality	760–763, 769–771 773–775, 777–779
B45 Senility without mention of psychosis, ill-defined and unknown causes	780–796
B46 All other diseases	Rest of 000–779
BE47 Motor vehicle accidents	E810–E823
BE48 All other accidents	E800–E807 E825–E949
BE49 Suicide and self-inflicted injuries	E950–E959
BE50 All other external causes	E960–N999
BN47 Fractures, intracranial and internal injuries	N800–N829 N850–N854 N860–N869
BN48 Burns	N940–N949
BN49 Adverse effects of chemical substances	N960–N989
BN50 All other injuries	Rest of N800–N999

APPENDIX III

LIST C—*List of 70 Causes for Tabulation of Morbidity*

C 1 Typhoid, paratyphoid fever, other salmonella infections	001–003
C 2 Bacillary dysentery and amoebiasis	004, 006
C 3 Enteritis and other diarrhoeal diseases	008, 009
C 4 Tuberculosis of respiratory system	010–012
C 5 Tuberculosis, other forms, including late effects	013–019
C 6 Brucellosis	023
C 7 Diphtheria	032
C 8 Whooping cough	033
C 9 Streptococcal sore throat and scarlet fever	034
C10 Smallpox	050
C11 Measles	055
C12 Viral encephalitis	062–065
C13 Infectious hepatitis	070
C14 Typhus and other rickettsioses	080–083
C15 Malaria	084
C16 Syphilis and its sequelae	090–097
C17 Gonococcal infections	098
C18 Helminthiasis	120–129

c19	All other infective and parasitic diseases	000, 005, 007 020–022, 024–027 030, 031, 035–039 040–046, 051–054 056, 057, 060, 061 066–068, 070–079 085–089, 099 100–104, 110–117 130–136
c20	Malignant neoplasms, including neoplasms of lymphatic and haematopoietic tissues	140–209
c21	Benign neoplasms and neoplasms of unspecified nature	210–239
c22	Thyrotoxicosis with or without goitre	242
c23	Diabetes mellitus	250
c24	Avitaminosis and other nutritional deficiency	260–269
c25	Other endocrine disorders; other metabolic diseases	240, 241, 243–246 251–258, 270–279
c26	Anaemias	280–285
c27	Psychoses and non-psychotic mental disorders	290–309
c28	Inflammatory diseases of eye	360–369
c29	Cataract	374
c30	Otitis media and mastoiditis	381–383
c31	Other diseases of nervous system and sense organs	320–324, 330–333 340–349, 350–358 370–373, 375–379 380, 384–389
c32	Active rheumatic fever	390–392
c33	Chronic rheumatic heart disease	393–398
c34	Hypertensive disease	400–404
c35	Ischaemic heart disease	410–414
c36	Cerebrovascular disease	430–438
c37	Venous thrombosis and embolism	450–453
c38	Other diseases of circulatory system	420–429, 440–447 454–458
c39	Acute respiratory infections	460–466
c40	Influenza	470–474
c41	Pneumonia	480–486
c42	Bronchitis, emphysema and asthma	490–493
c43	Hypertrophy of tonsils and adenoids	500
c44	Pneumoconioses and related diseases	515, 516
c45	Other respiratory diseases	501–508, 510–514 517–519
c46	Diseases of teeth and supporting structures	520–525
c47	Peptic ulcer	531–533
c48	Appendicitis	540–543
c49	Intestinal obstruction and hernia	550–553, 560
c50	Cholelithiasis and cholecystitis	574, 575
c51	Other diseases of digestive system	526–529, 530 534–537, 561–569 570–573, 576–577
c52	Nephritis and nephrosis	580–584
c53	Calculi of urinary system	592, 594

c54 Hyperplasia of prostate	600
c55 Other diseases of genito-urinary system	590, 591, 593 595–599, 601–607 610–616, 620–629
c56 Abortion	640–645
c57 Other complications of pregnancy, child-birth and the puerperium	630–639, 651–678
c58 Delivery without mention of complication	650
c59 Infections of skin and subcutaneous tissue	680–686
c60 Other diseases of skin and subcutaneous tissue	690–709
c61 Arthritis and spondylitis	710–715
c62 Other diseases of musculo-skeletal system and connective tissue	716–718, 720–729 730–738
c63 Congenital anomalies	740–759
c64 Certain causes of perinatal morbidity	760–779
c65 Other specified and ill-defined diseases	286–289, 310–315 780–796
CE66 Road transport accidents	E810–819, 825–827
CE67 Other accidents	E800–807, 820–823 830–949
CE68 Attempted suicide and self-inflicted injuries	E950–959
CE69 Attempted homicide and injury purposely inflicted by other person; legal intervention	E960–979
CE70 All other external causes	E980–999
CN66 Fractures	N800–829
CN67 Intracranial and internal injuries	N850–854, 860–869
CN68 Burns	N940–949
CN69 Adverse effects of chemical substances	N960–989
CN70 All other injuries	N830–848, 870–939 950–959, 990–999

APPENDIX IV

LIST D—*List of 300 Causes for Tabulation of Hospital Morbidity*

D 1 Cholera	000
D 2 Typhoid fever	001
D 3 Paratyphoid fever and other Salmonella infections	002, 003
D 4 Bacillary dysentery	004
D 5 Amoebiasis	006
D 6 Enteritis and diarrhoeal diseases	008, 009
D 7 Other intestinal infectious diseases	005, 007
D 8 Silicotuberculosis	010
D 9 Pulmonary tuberculosis	011
D 10 Tuberculosis pleurisy	012.1, 012.2
D 11 Tuberculosis laryngitis	012.3
D 12 Other respiratory tuberculosis	012.0, 012.9
D 13 Tuberculosis of meninges and central nervous system	013

D	14 Tuberculosis of intestines, peritoneum and mesenteric glands	014
D	15 Tuberculosis of bones and joints	015
D	16 Tuberculosis of genito-urinary system	016
D	17 Other tuberculosis	017–019
D	18 Plague	020
D	19 Brucellosis	023
D	20 Leprosy	030
D	21 Diphtheria	032
D	22 Whooping cough	033
D	23 Streptococcal sore throat and scarlet fever	034
D	24 Erysipelas	035
D	25 Meningococcal infection	036
D	26 Tetanus	037
D	27 Septicaemia	038
D	28 Other bacterial diseases	021, 022, 024–027 031, 039
D	29 Acute poliomyelitis	040–043
D	30 Late effects of acute poliomyelitis	044
D	31 Smallpox	050
D	32 Chickenpox	052
D	33 Measles	055
D	34 Rubella	056
D	35 Yellow fever	060
D	36 Viral encephalitis	062–065
D	37 Arthropod-borne haemorrhagic fever	067
D	38 Infectious hepatitis	070
D	39 Rabies	071
D	40 Mumps	072
D	41 Other viral diseases	045, 046, 051, 053 054, 057, 061, 066 068, 073–079
D	42 Typhus and other rickettsioses	080–083
D	43 Malaria	084
D	44 Leishmaniasis	085
D	45 Trypanosomiasis	086, 087
D	46 Relapsing fever	088
D	47 Early syphilis, symptomatic	091
D	48 Cardiovascular syphilis	093
D	49 Syphilis of central nervous system	094
D	50 Other syphilis	090, 092, 095–097
D	51 Gonococcal infections	098
D	52 Schistosomiasis	120
D	53 Hydatidosis	122
D	54 Ancylostomiasis	126
D	55 Other helminthiases	121, 123–125 127–129
D	56 Other infective and parasitic diseases	089, 099, 100–104 110–117, 130–136
D	57 Malignant neoplasm of buccal cavity and pharynx	140–149
D	58 Malignant neoplasm of stomach	151
D	59 Malignant neoplasm of intestine, except rectum	152, 153

D 60	Malignant neoplasm of rectum and rectosigmoid junction	154
D 61	Malignant neoplasm of other digestive organs and peritoneum	150, 155–159
D 62	Malignant neoplasm of larynx	161
D 63	Malignant neoplasm of trachea, bronchus and lung	162
D 64	Malignant neoplasm of other and unspecified respiratory organs	160, 163
D 65	Malignant neoplasm of bone	170
D 66	Malignant neoplasm of skin	172, 173
D 67	Malignant neoplasm of breast	174
D 68	Malignant neoplasm of cervix uteri	180
D 69	Chorionepithelioma	181
D 70	Other malignant neoplasm of uterus	182
D 71	Malignant neoplasm of ovary	183.0
D 72	Malignant neoplasm of other and unspecified female genital organs	183.1, 183.9, 184
D 73	Malignant neoplasm of prostate	185
D 74	Malignant neoplasm of testis	186
D 75	Malignant neoplasm of bladder	188
D 76	Malignant neoplasm of other genito-urinary organs	187, 189
D 77	Malignant neoplasm of brain	191
D 78	Malignant neoplasm of other specified sites	171, 190, 192–195
D 79	Secondary and unspecified malignant neoplasm of lymph nodes	196
D 80	Secondary malignant neoplasm of other sites and malignant neoplasm of unspecified site	197–199
D 81	Hodgkin's disease	201
D 82	Leukaemia	204–207
D 83	Other neoplasms of lymphatic and haematopoietic tissue	200, 202, 203 208, 209
D 84	Benign neoplasm of skin	216
D 85	Uterine fibromyoma	218
D 86	Other benign neoplasm of uterus	219
D 87	Benign neoplasm of ovary	220
D 88	Benign neoplasm of kidney and other urinary organs	223
D 89	Benign neoplasm of brain and other parts of nervous system	225
D 90	Other benign neoplasm	210–215, 217, 221 222, 224, 226–228
D 91	Carcinoma *in situ* of cervix uteri	234.0
D 92	Other neoplasm of unspecified nature	230–233, 234.1 234.9, 235–239
D 93	Non-toxic goitre	240, 241
D 94	Thyrotoxicosis with or without goitre	242
D 95	Other diseases of thyroid gland	243–246
D 96	Diabetes mellitus	250
D 97	Avitaminoses and other nutritional deficiency	260–269
D 98	Other endocrine and metabolic diseases	251–258, 270–279
D 99	Iron deficiency anaemias	280
D100	Vitamin B12 deficiency anaemia	281.0, 281.1
D101	Other deficiency anaemias	281.2–281.9
D102	Other diseases of blood and blood-forming organs	282–289

D103	Alcoholic psychosis	291
D104	Schizophrenia	295
D105	Affective psychoses	296
D106	Other psychoses	290, 292–294, 297–299
D107	Neuroses	300
D108	Alcoholism	303
D109	Other non-psychotic mental disorders	301, 302, 304–309
D110	Mental retardation	310–315
D111	Meningitis	320
D112	Other inflammatory diseases of central nervous system	321–324
D113	Hereditary and familial diseases of nervous system	330–333
D114	Multiple sclerosis	340
D115	Paralysis agitans	342
D116	Epilepsy	345
D117	Other diseases of central nervous system	341, 343, 344, 346–349
D118	Sciatica	353
D119	Other diseases of nerves and peripheral ganglia	350–352, 354–358
D120	Keratitis with ulceration	363.0
D121	Iritis, choroiditis and other inflammation of uveal tract	364–366
D122	Inflammation of lachrymal glands and ducts	368
D123	Other inflammatory diseases of eye	360–362, 363.9, 367, 369
D124	Strabismus	373
D125	Cataract	374
D126	Glaucoma	375
D127	Detachment of retina	376
D128	Other diseases of eye	370–372, 377–379
D129	Otitis media without mention of mastoiditis	381
D130	Mastoiditis with or without otitis media	382, 383
D131	Other diseases of ear and mastoid process	380, 384–389
D132	Active rheumatic fever	390–392
D133	Chronic rheumatic heart disease	393–398
D134	Essential benign hypertension	401
D135	Hypertensive heart disease	402, 404
D136	Other hypertensive disease	400, 403
D137	Acute myocardial infarction	410
D138	Other ischaemic heart disease	411–414
D139	Symptomatic heart disease	427
D140	Other disease of heart	420–426, 428, 429
D141	Cerebral haemorrhage	431
D142	Cerebral infarction	432–434
D143	Acute but ill-defined cerebrovascular disease	436
D144	Other cerebrovascular disease	430, 435, 437, 438
D145	Arteriosclerosis	440
D146	Other peripheral vascular disease	443
D147	Other diseases of arteries, arterioles and capillaries	441, 442, 444–447
D148	Pulmonary embolism and infarction	450
D149	Phlebitis, thrombophlebitis, venous embolism and thrombosis	451–453

D150	Varicose veins of lower extremities	454
D151	Haemorrhoids	455
D152	Other diseases of veins and lymphatics, and of circulatory system	456–458
D153	Acute pharyngitis and acute tonsillitis	462, 463
D154	Acute bronchitis and bronchiolitis	466
D155	Other acute respiratory infections	460, 461, 464, 465
D156	Influenza	470–474
D157	Viral pneumonia	480
D158	Pneumococcal pneumonia	481
D159	Pneumonia due to other specified organism	482, 483
D160	Pneumonia without specification of organism	484–486
D161	Bronchitis, emphysema and asthma	490–493
D162	Hypertrophy of tonsils and adenoids	500
D163	Chronic sinusitis	503
D164	Deflected nasal septum	504
D165	Other diseases of upper respiratory tract	501, 502, 505–508
D166	Empyema and abscess of lung	510, 513
D167	Pleurisy	511
D168	Pneumoconioses and related diseases	515, 516
D169	Bronchiectasis	518
D170	Other diseases of respiratory system	512, 514, 517, 519
D171	Diseases of teeth and supporting structures	520–525
D172	Other diseases of oral cavity, salivary glands and jaws	526–529
D173	Ulcer of stomach	531
D174	Ulcer of duodenum	532
D175	Peptic ulcer, site unspecified	533
D176	Gastrojejunal ulcer	534
D177	Gastritis and duodenitis	535
D178	Other diseases of oesophagus, stomach and duodenum	530, 536, 537
D179	Acute appendicitis	540
D180	Other appendicitis	541–543
D181	Inguinal hernia without mention of obstruction	550
D182	Other hernia without mention of obstruction	551
D183	Hernia with obstruction	552, 553
D184	Intestinal obstruction without mention of hernia	560
D185	Chronic enteritis and ulcerative colitis	563
D186	Anal fissure and fistula	565
D187	Abscess of anal and rectal regions	566
D188	Other diseases of intestines and peritoneum	561, 562, 564 567–569
D189	Cirrhosis of liver	571
D190	Cholelithiasis and cholecystitis	574, 575
D191	Other diseases of liver and gall bladder	570, 572, 573, 576
D192	Diseases of pancreas	577
D193	Acute nephritis	580
D194	Other nephritis and nephrosis	581–584
D195	Infections of kidney	590
D196	Calculi of urinary system	592, 594
D197	Cystitis	595
D198	Stricture of urethra	598

D199	Other diseases of urinary system	591, 593, 596, 597, 599
D200	Hyperplasia of prostate	600
D201	Hydrocele	603
D202	Redundant prepuce and phimosis	605
D203	Other diseases of male genital organs	601, 602, 604, 606, 607
D204	Diseases of breast	610, 611
D205	Salpingitis and oophoritis	612–614
D206	Other diseases of ovary, Fallopian tube and parametrium	615, 616
D207	Infective disease of cervix uteri	620
D208	Infective disease of uterus (except cervix), vagina and vulva	622
D209	Uterovaginal prolapse	623
D210	Malposition of uterus	624
D211	Disorders of menstruation	626
D212	Sterility, female	628
D213	Other diseases of female genital organs	621, 625, 627, 629
D214	Infections of genito-urinary tract during pregnancy and the puerperium	630, 635
D215	Threatened abortion	632.3
D216	Other haemorrhage of pregnancy	632.0–632.2, 632.4, 632.5
D217	Pregnancy with malposition of foetus in uterus	634.0
D218	Toxaemias of pregnancy and the puerperium	636–639
D219	Other complications of pregnancy	631, 633, 634.1, 634.9
D220	Abortion induced for legal indications	640, 641
D221	Other and unspecified abortion	642–645
D222	Delivery without mention of complication	650
D223	Delivery complicated by placenta praevia or ante-partum haemorrhage	651
D224	Delivery complicated by retained placenta or other post-partum haemorrhage	652, 653
D225	Delivery complicated by abnormality of bony pelvis, disproportion, malpresentation or other prolonged labour	654–657
D226	Delivery with other complications, including anaesthetic death	658–662
D227	Complications of the puerperium	670–678
D228	Infections of skin and subcutaneous tissues	680–686
D229	Other inflammatory conditions of skin and subcutaneous tissues	690–698
D230	Other diseases of skin and subcutaneous tissues	700–709
D231	Rheumatoid arthritis and allied conditions	712
D232	Osteo-arthritis and allied conditions	713
D233	Other and unspecified arthritis	710, 711, 714, 715
D234	Non-articular rheumatism and rheumatism unspecified	716–718
D235	Osteomyelitis and periostitis	720
D236	Other diseases of bone	721–723
D237	Internal derangement of joint	724
D238	Displacement of intervertebral disc	725

D239 Vertebrogenic pain syndromes	728
D240 Other diseases of joint	726, 727, 729
D241 Synovitis, bursitis and tenosynovitis	731
D242 Hallux valgus and varus	737
D243 Other diseases of musculoskeletal system	730, 732–736, 738
D244 Spina bifida and congenital hydrocephalus	741, 742
D245 Congenital anomalies of circulatory system	746, 747
D246 Cleft palate and cleft lip	749
D247 Congenital pyloric stenosis	750.1
D248 Other congenital anomalies of digestive system	750.0, 750.2–750.9 751
D249 Undescended testicle	752.1
D250 Other congenital anomalies of genito-urinary system	752.0, 752.2–752.9 753
D251 Congenital clubfoot	754
D252 Congenital dislocation of hip	755.7
D253 Other congenital anomalies of musculoskeletal system	755.0–755.6, 755.8 755.9, 756
D254 Other and unspecified congenital anomalies	740, 743–745, 748 757–759
D255 Birth injury	764–768 with 4th digits .0–.3, 772
D256 Asphyxia, anoxia or hypoxia	764–768 with 4th digit .4, 776
D257 Haemolytic disease of newborn	774, 775
D258 Immaturity, unspecified	777
D259 Other causes of perinatal morbidity and mortality	760–763, 764–768 4th digit .9, 769, 770 771, 773, 778, 779
D260 Acute heart failure, undefined	782.4
D261 Haematemesis	784.5
D262 Abdominal pain	785.5
D263 Pain referable to urinary system	786.0
D264 Retention of urine	786.1
D265 Incontinence of urine	786.2
D266 Other symptoms	780, 781 782.0–782.3 782.5–782.9, 783 784.0–784.4 784.6–784.8 785.0–785.4 785.6–785.9 786.3–786.7 787–789
D267 Senility without mention of psychosis	794
D268 Other ill-defined conditions	790–793, 795, 796
DY269 Normal pregnancy	Y60.0
DY270 Live births in hospital	Y80–Y89
DY271 Other special admissions or consultations	Y00–Y59 Y60.1–Y60.9 Y61–Y79

DE272	Railway accidents	E800–E807
DE273	Motor vehicle accident to occupant of motor vehicle	E810–E823 with 4th digits .0–.3
DE274	Motor vehicle accident to pedal cyclist	810–823 with 4th digit .6
DE275	Motor vehicle accident to pedestrian	E810–E823 with 4th digit .7
DE276	Motor vehicle accident to other and unspecified person	E810–E823 with 4th digits .4, .5, .8, .9
DE277	Other road vehicle accidents	E825–E827
DE278	Water transport accidents	E830–E838
DE279	Air and space transport accidents	E840–E845
DE280	Accidental poisoning by drugs and medicaments	E850–E859
DE281	Accidental poisoning by other solid and liquid substances	E860–E869
DE282	Accidental poisoning by gases and vapours	E870–E877
DE283	Accidental fall on or from stairs, steps, ladders or scaffolding	E880–E881
DE284	Other fall from one level to another	E882–E884
DE285	Fall on same level	E885, E886
DE286	Unspecified fall	E887
DE287	Conflagrations	E890–E892
DE288	Ignition of clothing or inflammable material	E893, E894
DE289	Accidents from controlled fires	E895–E897
DE290	Other and unspecified fires	E898, E899
DE291	Drowning and submersion	910
DE292	Accident caused by firearms weapons	E922
DE293	Surgical and medical complications and misadventures	E930–E936
DE294	Other and unspecified accidents, including late effects	E900–E909 E911–E921 E923–E929 E940–E949
DE295	Suicide and self-inflicted injury by poisoning by solid or liquid substances	E950
DE296	Suicide and self-inflicted injury by poisoning by gases in domestic use	E951
DE297	Suicide and self-inflicted injury by other and unspecified means, including late effects	E952–E954 E955–E959
DE298	Homicide and injury purposely inflicted by other persons; legal intervention	E960–E969 E970–E979
DE299	Injury undetermined whether accidentally or purposely inflicted	E980–E989
DE300	Injury resulting from operations of war	E990–E999
DN272	Fracture of face bones	N802
DN273	Other fracture of skull	N800, N801 N803, N804
DN274	Fracture of spine and trunk	N805–N809
DN275	Fracture of humerus, radius and ulna	N812, N813
DN276	Fracture of phalanges and metacarpal bones	N815–N817
DN277	Fracture of neck of femur	N820

DN278	Fracture of other and unspecified parts of femur	N821
DN279	Fracture of tibia, fibula and ankle	N823, N824
DN280	Other fractures of limbs	N810, N811 N814, N818 N819, N822 N825–N829
DN281	Dislocation without fracture; sprains and strains of joints and adjacent muscles	N830–N848
DN282	Intracranial injury (excluding skull fracture)	N850–N854
DN283	Internal injury of chest, abdomen and pelvis	N860–N869
DN284	Laceration, open wound, superficial injury, contusion and crushing, affecting eye	N870, N871 N921
DN285	Laceration, open wound, superficial injury, contusion and crushing, affecting hand and fingers	N882, N883 N885–N887 N903, N914 N915, N925 N926
DN286	Laceration, open wound, superficial injury, contusion and crushing, affecting other and unspecified site	N872–N879 N880, N881, N884 N890–N897 N900–N902 N904–N908 N910–N913 N916–N918 N920, N922–N924 N927–N929
DN287	Foreign body in eye and adnexa	N930
DN288	Foreign body entering through other orifice	N931–N939
DN289	Burn confined to eye	N940
DN290	Burn of other and unspecified site	N941–N949
DN291	Adverse effects of salicylates and congeners	N965.1
DN292	Adverse effects of barbiturates	N967.0
DN293	Adverse effects of other medicinal agents	N960–N964, N965.0 N965.2–N965.9 N966 N967.1–N967.9 N968–N979
DN294	Toxic effect of carbon monoxide	N986
DN295	Toxic effect of other substances chiefly non-medicinal as to source	N980–N985 N987–N989
DN296	Drowning and non-fatal submersion	N994.1
DN297	Asphyxiation and strangulation	N995.5
DN298	Injury, other and unspecified	N997
DN299	Complications of surgical procedures and other medical care	N998 N999
DN300	Other effects of external causes	N950–N959 N990–N993 N994.0 N994.2–N994.9 N995.0–N995.4 N995.6–N995.9 N996

APPENDIX V

LIST P—*List of 100 Causes for Tabulation of Pernatal Morbidity and Mortality*

CHRONIC CIRCULATORY AND GENITO-URINARY DISEASE IN MOTHER (1–4) (1–4)		
P	1 Chronic rheumatic heart disease	760.0
P	2 Chronic hypertension	760.2
P	3 Other chronic disease of circulatory system	760.1, 760.3
P	4 Chronic disease of genito-urinary system	760.4, 760,5
OTHER MATERNAL CONDITIONS UNRELATED TO PREGNANCY (5–11)		
P	5 Syphilis	761.0
P	6 Diabetes mellitus	761.1
P	7 Rubella	761.3
P	8 Injury to mother	761.5
P	9 Operation of mother	761.6
P	10 Chemical substances transmitted through placenta	761.7
P	11 Other maternal conditions	761.2, 761.4, 761.9
TOXAEMIAS OF PREGNANCY (12–17)		
P	12 Renal disease arising during pregnancy	762.0
P	13 Pre-eclampsia of pregnancy	762.1
P	14 Eclampsia of pregnancy	762.2
P	15 Toxaemia unspecified	762.3
P	16 Hyperemesis gravidarum	762.4
P	17 Other toxaemia of pregnancy	762.5, 762.9
MATERNAL ANTE- AND INTRA-PARTUM INFECTION (18–20)		
P	18 Pyelitis and pyelonephritis of pregnancy	763.0
P	19 Other infections of genito-urinary tract during pregnancy	763.1
P	20 Other	763.9
DIFFICULT LABOUR WITH ABNORMALITY OF BONES, ORGANS OR TISSUES OF PELVIS (21–23)		
P	21 With birth injury to brain or spinal cord	760.4, 764.1
P	22 With other or unspecified birth injury	764.2, 764.3
P	23 Without mention of birth injury	764.4, 764.9
DIFFICULT LABOUR WITH DISPROPORTION (24–26)		
P	24 With birth injury to brain or spinal cord	765.0, 765.1
P	25 With other or unspecified birth injury	765.2, 765.3
P	26 Without mention of birth injury	765.4, 765.9
DIFFICULT LABOUR WITH MALPOSITION OF FOETUS (27–29)		
P	27 With birth injury to brain or spinal cord	766.0, 766.1
P	28 With other or unspecified birth injury	766.2, 766.3
P	29 Without mention of birth injury	766.4, 766.9
DIFFICULT LABOUR WITH ABNORMALITY OF FORCES OF LABOUR (30–32)		
P	30 With birth injury to brain or spinal cord	757,0 767.1
P	31 With other or unspecified birth injury	767.2, 767.3
P	32 Without mention of birth injury	767.4, 767.9

DIFFICULT LABOUR WITH OTHER AND UNSPECIFIED COMPLICATIONS (33–35)	
P 33 With birth injury to brain or spinal cord	768.0, 768.1
P 34 With other or unspecified birth injury	768.2, 768.3
P 35 Without mention of birth injury	768.4, 768.9
OTHER COMPLICATIONS OF PREGNANCY AND CHILD-BIRTH (36–41)	
P 36 Incompetent cervix	769.0
P 37 Premature rupture of membranes	769.1
P 38 Hydramnios	769.2
P 39 Ectopic pregnancy	769.3
P 40 Multiple pregnancy	769.4
P 41 Other complications of pregnancy or child-birth	769.5, 769.9
CONDITIONS OF PLACENTA (42–46)	
P 42 Placenta praevia	770.0
P 43 Premature separation of placenta	770.1
P 44 Placental infarction	770.2
P 45 Other conditions of placenta	770.8
P 46 Placental insufficiency, unspecified	770.9
CONDITIONS OF UMBILICAL CORD (47–49)	
P 47 Compression of cord	771.0
P 48 Prolapse of cord without mention of compression	771.1
P 49 Other	771.9
BIRTH INJURY WITHOUT MENTION OF CAUSE (50–52)	
P 50 To brain or spinal cord	772.0, 772.1
P 51 Other or unspecified birth injury	772.2, 772.9
P 52 Termination of pregnancy without mention of cause	773
HAEMOLYTIC DISEASE OF NEWBORN (53–56)	
P 53 With Rh incompatibility	774.0, 775.0
P 54 With ABO incompatibility	774.1, 775.1
P 55 With other or unspecified blood incompatibility	774.2, 775.2
P 56 Without mention of cause	774.9, 775.9
ANOXIC AND HYPOXIC CONDITIONS NOT ELSEWHERE CLASSIFIED (57–60)	
P 57 Hyaline membrane disease and respiratory distress syndrome	776.1, 776.2
P 58 Intra uterine anoxia	776.4
P 59 Asphyxia of newborn, unspecified	776.9
P 60 Other anoxic and hypoxic conditions not elsewhere classified	776.0 776.3
OTHER CONDITIONS OF FOETUS AND NEWBORN (61–68)	
P 61 Immaturity unspecified	777
P 62 Foetal blood loss before birth	778.0
P 63 Chorio-amnionitis	778.1
P 64 Post maturity	778.2
P 65 Haemorrhagic disease of newborn	778.3
P 66 Other conditions of foetus	778.4, 778.9
P 67 Maceration foetal death or unknown cause	779.0
P 68 Other	779.9
CONGENITAL ANOMALIES (69–80)	
P 69 Anencephalus	740
P 70 Spina bifida	741
P 71 Congenital hydrocephalus	742
P 72 Other congenital anomalies of central nervous system and eye	743, 744

P 73	Congenital anomalies of circulatory system	746, 747
P 74	Congenital anomalies of respiratory system	748
P 75	Congenital anomalies of digestive system	749, 751
P 76	Congenital anomalies of genito-urinary system	752, 753
P 77	Congenital anomalies of musculo-skeletal system	754–756
P 78	Down's syndrome congenital syndromes affecting multiple systems	759.3
P 79	Other	759.0–759.2, 759.4–759.9
P 80	Other and unspecified congenital anomalies	745, 757, 758
INFECTIONS OF FOETUS AND NEWBORN (81–88)		
P 81	Diarrhoeal disease	009
P 82	Listeriosis	027.0
P 83	Tetanus	037
P 84	Septicaemia	038
P 85	Viral diseases	040–079
P 86	Congenital syphilis	090
P 87	Toxoplasmosis	130
P 88	Other infective and parasitic diseases	Rest of 000–136
OTHER DISEASES OF FOETUS AND NEWBORN (89–94)		
P 89	Diseases of thyroid gland	240–246
P 90	Cystic fibrosis (mucoviscidosis)	273.0
P 91	Diseases of blood and blood-forming organs	280–289
P 92	Pneumonia	480–486
P 93	Other specified conditions	Rest of 140–738
P 94	Symptoms and ill-defined conditions	780–796
ACCIDENTS AND VIOLENCE TO NEWBORN (95–100)		
P 95	Excessive heat	E900
P 96	Excessive cold	E901
P 97	Hunger, thirst, exposure and neglect	E904
P 98	Inhalation and ingestion of food causing obstruction or suffocation	E911
P 99	Accidental mechanical suffocation	E913
P100	Other violence	Rest of E800–E999

APPENDIX VI

LIST OF 51 CAUSES FOR THE USE OF MEDICAL AUXILIARY PERSONNEL[56]

1. Syphilis
2. Gonorrhoea
3. Other venereal diseases
4. Whooping cough
5. Cerebrospinal meningitis
6. Plague
7. Leprosy
8. Tetanus
9. Yaws
10. Smallpox
11. Measles
12. Chickenpox
13. Mumps
14. Malaria
15. Blackwater fever
16. Trypanosomiasis
17. Bilharziasis (vesical)
18. Guinea worm
19. Elephantiasis
20. Intestinal worms
21. Scabies
22. Goitre
23. Mental disorders
24. Epilepsy
25. Blindness
26. Conjunctivitis
27. Other conditions of the eyes and eyelids
28. Diseases of the ear
29. Deafness
30. Heart diseases
31. Common cold
32. Sore throat
33. Bronchitis
34. Pneumonia
35. Diseases of the mouth and teeth
36. Nausea and vomiting
37. Stomach ache
38. Constipation
39. Diarrhoea
40. Diarrhoea with blood
41. Diseases of the genito-urinary system (excluding syphilis, yaws, gonorrhoea, and other venereal diseases)
42. Normal deliveries
43. Complications of pregnancy and delivery
44. Abortions and stillbirths
45. Chronic ulcer (of the skin)
46. Diseases of the skin and soft tissues (excluding scabies)
47. Diseases of the bones and joints
48. Other diseases and conditions not mentioned above
49. Injuries to the soft tissues
50. Injuries to the bones and joints
51. Other injuries

APPENDIX VII

Measurement of Morbidity
Rates of Inception and Prevalence[40, 84]

RATES RELATING TO INCEPTION

1. Rate of Inception of spells ***of sickness***

'The number of **spells** *of sickness* which **start** during a defined period divided by the average number of persons exposed to risk during that period.'

Short title: 'Inception rate (spells).'

NOTES:

(*a*) Several 'spells' begun by any one person during the defined period of observation must each be counted separately.

(*b*) The relevant 'spells' in the numerator comprise only:
 (i) Spells beginning and ending in the period,
 (ii) Spells beginning in the period and still continuing at the end of the period.

(*c*) If some 'spells' relate to more than one disease (i.e. concurrent or consecutive diseases within the same spell) and if, in using the rates in relation to individual diseases, such spells are counted for each of the diseases separately, then the rates for individual diseases cannot be aggregated to give the equivalent rate for all diseases combined.

(*d*) When first 'spells' due to a particular disease can be distinguished from subsequent 'spells' for the same disease, this definition may be adapted to relate to the first 'spells' only.

(*e*) In many studies of morbidity the full frequency distribution, showing numbers of persons who begin different numbers of spells, will be required; such information is valuable in studying variations in people's individual tendency towards repeated sickness.

(*f*) It may sometimes be easier to derive a **rate of termination** of spells from the available records instead of a **rate of inception.** The uses of such a rate would be similar and, when the duration of sickness is short in relation to the period of observation, the two rates would, in effect, be interchangeable.

2. Proportion of persons who start a spell ***of sickness*** **during a period**

'The number of **persons** who **start** at least one spell *of sickness* during a defined period divided by the average number of persons exposed to risk during that period.'

Short title: 'Inception rate (persons).'

NOTES:

(*a*) Persons who begin more than one 'spell' during the period of observation must be counted **once** only.

(*b*) The relevant persons in the numerator comprise only those with:
 (i) Spells beginning and ending in the period,
 (ii) Spells beginning in the period and still continuing at the end of the period.

(*c*) If some persons are sick from more than one disease (i.e. at the same time or on successive occasions within the period of observation) and if, in using the rate in relation to individual diseases, such persons are counted for each of the diseases separately, then the rates for individual diseases cannot be aggregated to give the equivalent rate for all diseases combined.

RATES RELATING TO PREVALENCE

3(A). Rate of Prevalence of spells *of sickness* in a period

'The number of **spells** *of sickness* which are **current at some time** during a defined period divided by the average number of persons exposed to risk during that period.'

Short title: 'Period Prevalence rate (spells).'

NOTES:

(*a*) Several 'spells' experienced by any one person during the defined period of observation must each be counted separately.

(*b*) The relevant 'spells' in the numerator comprise:
 (i) Spells beginning and ending in the period,
 (ii) Spells beginning in the period and still continuing at the end of the period,
 (iii) Spells beginning before and ending in the period,
 (iv) Spells beginning before the period and still continuing at the end of the period.

(*c*) If some 'spells' relate to more than one disease (i.e. concurrent or consecutive diseases within the same spell) and if, in using the rate in relation to individual diseases, such spells are counted for each of the diseases separately, then the rate for individual diseases cannot be aggregated to give the equivalent rate for all diseases combined.

(*d*) In many studies of morbidity the full frequency distribution, showing numbers of person who experience different numbers of spells, will be required; such information is valuable in studying variations in people's individual tendency towards repeated sickness.

3(B). Rate of Prevalence of spells *of sickness* at a point of time

'The number of **spells** *of sickness* which are current **at a given time** divided by the number of persons exposed to risk at that time.'

Short title: 'Point Prevalence rate.'

NOTES:

(*a*) The rate will be numerically the same as rate 4(B) below.

(*b*) The number of spells may be based on an actual count at a specific point of time or may be an average calculated for a specific point of time.

(*c*) If some 'spells' relate to more than one disease current at the given time and if, in using the rate in relation to individual diseases, such spells are counted for each of the diseases separately, then the rates for individual diseases cannot be aggregated to give the equivalent rate for all diseases combined.

4(A). Proportion of persons *sick* in a period

'The number of **persons** who *are sick* **some time** during a defined period divided by the average number of persons exposed to risk during that period.'

Short title: 'Period Prevalence rate (persons).'

NOTES:

(*a*) The complement of this rate may be useful, i.e. the proportion of persons who were never sick during the period.

(*b*) Persons who experience more than one 'spell' during the period of observation must be counted **once** only.

(*c*) The relevant persons in the numerator comprise those with:
 (i) Spells beginning and ending in the period,
 (ii) Spells beginning in the period and still continuing at end of the period
 (iii) Spells beginning before and ending in the period,
 (iv) Spells beginning before the period and still continuing at the end of the period.

(*d*) If some persons are sick from more than one disease (i.e. at the same time or on successive occasions within the period of observation) and if, in using the rate in relation to individual diseases, such persons are counted for each of the diseases separately, then the rates for individual diseases cannot be aggregated to give the equivalent rate for all diseases combined.

4(B). Proportion of persons *sick* at a point of time.

'The number of **persons** who *are sick* at a **given time** divided by the number of persons exposed to risk at that time.'

Short title: 'Point Prevalence rate.'

NOTES:

(*a*) The rate will be numerically the same as rate 3 (B) above.

(*b*) The number of persons may be based on an actual count at a specific point of time or may be an average calculated for a specific point of time.

(*c*) If some persons are sick from more than one disease at the given time and if, in using the rate in relation to individual diseases, such persons are counted for each of the diseases separately, then the rates for individual diseases cannot be aggregated to give the equivalent rate for all diseases combined.

APPENDIX VIII

The International Standard Classification of Occupations (1967)

MAJOR GROUP 0/1: PROFESSIONAL, TECHNICAL AND RELATED WORKERS

0–1 Physical Scientists and Related Technicians
- 0–11 Chemists
- 0–12 Physicists
- 0–13 Physical scientists not elsewhere classified
- 0–14 Physical science technicians

0–2/0–3 Architects, Engineers and Related Technicians
- 0–21 Architects and town planners
- 0–22 Civil engineers
- 0–23 Electrical and electronics engineers
- 0–24 Mechanical engineers
- 0–25 Chemical engineers
- 0–26 Metallurgists
- 0–27 Mining engineers
- 0–28 Industrial engineers
- 0–29 Engineers not elsewhere classified
- 0–31 Surveyors
- 0–32 Draughtsmen

0–33 Civil engineering technicians
0–34 Electrical and electronic engineering technicians
0–35 Mechanical engineering technicians
0–36 Chemical engineering technicians
0–37 Metallurgical technicians
0–38 Mining technicians
0–39 Engineering technicians not elsewhere classified

0–4 Aircraft and Ships' Officers
0–41 Aircraft pilots, navigators and flight engineers
0–42 Ships' deck officers and pilots
0–43 Ships' engineers

0–5 Life Scientists and Related Technicians
0–51 Biologists, zoologists and related scientists
0–52 Bacteriologists, pharmacologists and related scientists
0–53 Agronomists and related scientists
0–54 Life sciences technicians

0–6/0–7 Medical, Dental, Veterinary and Related Workers
0–61 Medical doctors
0–62 Medical assistants
0–63 Dentists
0–64 Dental assistants
0–65 Veterinarians
0–66 Veterinary assistants
0–67 Pharmacists
0–68 Pharmaceutical assistants
0–69 Dieticians and Public Health Nutritionists
0–71 Professional nurses
0–72 Nursing personnel, not elsewhere classified
0–73 Professional midwives
0–74 Midwifery personnel, not elsewhere classified
0–75 Optometrists and opticians
0–76 Physiotherapists and occupational therapists
0–77 X-ray technicians
0–79 Medical, dental, veterinary and related workers not elsewhere classified

0–8 Statisticians, Mathematicians, Systems Analysts and Related Technicians
0–81 Statisticians
0–82 Mathematicians and actuaries
0–83 Systems analysts
0–84 Statistical and mathematical technicians

0–9 Economists
0–90 Economists

1–1 Accountants
1–10 Accountants

1–2 Jurists
1–21 Lawyers
1–22 Judges
1–29 Jurists not elsewhere classified

1–3 Teachers
1–31 University and higher education teachers
1–32 Secondary education teachers
1–33 Primary education teachers

1–34 Pre-primary education teachers
1–35 Special education teachers
1–39 Teachers not elsewhere classified

1–4 Workers in Religion
1–41 Ministers of religion and related members of religious orders
1–49 Workers in religion not elsewhere classified

1–5 Authors, Journalists and Related Writers
1–51 Authors and critics
1–59 Journalists and related writers not elsewhere classified

1–6 Sculptors, Painters, Photographers and Related Creative Artists
1–61 Sculptors, painters and related artists
1–62 Commercial artists and designers
1–63 Photographers and cameramen

1–7 Composers and Performing Artists
1–71 Composers, musicians and singers
1–72 Choreographers and dancers
1–73 Actors and stage directors
1–74 Producers (performing arts)
1–75 Circus performers
1–79 Performing artists not elsewhere classified

1–8 Athletes, Sportsmen and Related Workers
1–80 Athletes, sportsmen and related workers

1–9 Professional and Technical Workers not Elsewhere Classified
1–91 Librarians, archivists and curators
1–92 Sociologists, anthropologists and related scientists
1–93 Social workers
1–94 Personnel and occupational specialists
1–95 Philologists, translators and interpreters
1–99 Other professional and technical workers

MAJOR GROUP 2: ADMINISTRATIVE AND MANAGERIAL WORKERS

2–0 Legislative Officials and Government Administrators
2–01 Legislative officials
2–02 Government administrators

2–1 Managers
2–11 General managers
2–12 Production managers (except farm)
2–19 Managers not elsewhere classified

MAJOR GROUP 3: CLERICAL AND RELATED WORKERS

3–0 Clerical Supervisors
3–00 Clerical supervisors

3–1 Government, Executive Officials
3–10 Government executive officials

3–2 Stenographers, Typists and Card and Tape Punching Machine Operators
3–21 Stenographers, typists and teletypists
3–22 Card and tape punching machine operators

3–3 Bookkeepers, Cashiers and Related Workers
3–31 Bookkeepers and cashiers
3–39 Bookkeepers, cashiers and related workers not elsewhere classified

3–4 Computing Machine Operators
- 3–41 Bookkeeping and calculating machine operators
- 3–42 Automatic data processing machine operators

3–5 Transport and Communications Supervisors
- 3–51 Railway station masters
- 3–52 Postmasters
- 3–59 Transport and communications supervisors n.e.c.

3–6 Transport Conductors
- 3–60 Transport conductors

3–7 Mail Distribution Clerks
- 3–70 Mail distribution clerks

3–8 Telephone and Telegraph Operators
- 3–80 Telephone and telegraph operators

3–9 Clerical and Related Workers not elsewhere classified
- 3–91 Stock clerks
- 3–92 Material and production planning clerks
- 3–93 Correspondence and reporting clerks
- 3–94 Receptionists and travel agency clerks
- 3–95 Library and filing clerks
- 3–99 Clerks not elsewhere classified

MAJOR GROUP 4: SALES WORKERS

4–0 Managers (Wholesale and Retail Trade)
- 4–00 Managers (wholesale and retail trade)

4–1 Working Proprietors (Wholesale and Retail Trade)
- 4–10 Working Proprietors (wholesale and retail trade)

4–2 Sales Supervisors and Buyers
- 4–11 Sales supervisors
- 4–12 Buyers

4–3 Technical Salesmen, Commercial Travellers and Manufacturers' Agents
- 4–31 Technical salesmen and service advisers
- 4–32 Commercial travellers and manufacturers' agents

4–4 Insurance, Real Estate, Securities and Business Services, Salesmen and Auctioneers
- 4–41 Insurance, real estate and securities salesmen
- 4–42 Business services salesmen
- 4–43 Auctioneers

4–5 Salesmen, Shop Assistants and Related Workers
- 4–51 Salesmen, shop assistants and demonstrators
- 4–52 Street vendors, canvassers and newsvendors

4–9 Sales Workers not elsewhere classified
- 4–90 Sales Workers not elsewhere classified

MAJOR GROUP 5: SERVICE WORKERS

5–0 Managers (Catering and Lodging Services)
- 5–00 Managers (catering and lodging services)

5–1 Working Proprietors (Catering and Lodging Services)
- 5–10 Working Proprietors (catering and lodging services)

5–2 Housekeeping and Related Service Supervisors
- 5–20 Housekeeping and related service supervisors

5–3 Cooks, Waiters, Bartenders and Related Workers
- 5–31 Cooks

5–32 Waiters, bartenders and related workers
5–4 Maids and Related Housekeeping Service Workers not elsewhere classified
5–40 Maids and related housekeeping service workers not elsewhere classified
5–5 Building Caretakers, Charworkers, Cleaners and Related Workers
5–51 Building caretakers
5–52 Charworkers, cleaners and related workers
5–6 Launderers, Dry-Cleaners and Pressers
5–60 Launderers, dry-cleaners and pressers
5–7 Hairdressers, Barbers, Beauticians and Related Workers
5–70 Hairdressers, barbers, beauticians and related workers
5–8 Protective Service Workers
5–81 Fire fighters
5–82 Policemen and detectives
5–89 Protective service workers not elsewhere classified
5–9 Service Workers not elsewhere classified
5–91 Guides
5–92 Undertakers and embalmers
5–99 Other service workers

MAJOR GROUP 6: AGRICULTURAL, ANIMAL HUSBANDRY AND FORESTRY WORKERS, FISHERMEN AND HUNTERS

6–0 Farm Managers and Supervisors
6–00 Farm managers and supervisors
6–1 Farmers
6–11 General farmers
6–12 Specialised farmers
6–2 Agricultural and Animal Husbandry Workers
6–21 General farm workers
6–22 Field crop and vegetable growing workers
6–23 Orchard, vineyard and related tree and shrub crop workers
6–24 Livestock workers
6–25 Dairy farm workers
6–26 Poultry farm workers
6–27 Nursery workers and gardeners
6–28 Farm machinery operators
6–29 Agricultural and animal husbandry workers not elsewhere classified
6–3 Forestry Workers
6–31 Loggers
6–32 Forestry workers (except loggers)
6–4 Fishermen, Hunters and Related Workers
6–41 Fishermen
6–49 Fishermen, hunters and related workers not elsewhere classified

MAJOR GROUP 7/8/9: PRODUCTION AND RELATED WORKERS, TRANSPORT EQUIPMENT OPERATORS AND LABOURERS

7–0 Production Supervisors and General Foremen
7–00 Production supervisors and general foremen
7–1 Miners, Quarrymen, Well Drillers and Related Workers
7–11 Miners and quarrymen
7–12 Mineral and stone treaters
7–13 Well drillers, borers and related workers

7–2 Metal Processers
- 7–21 Metal smelting, converting and refining furnacemen
- 7–22 Metal rolling mill workers
- 7–23 Metal melters and reheaters
- 7–24 Metal casters
- 7–25 Metal moulders and coremakers
- 7–26 Metal annealers, temperers and case hardeners
- 7–27 Metal drawers and extruders
- 7–28 Metal platers and coaters
- 7–29 Metal processers not elsewhere classified

7–3 Wood Preparation Workers and Paper Makers
- 7–31 Wood treaters
- 7–32 Sawyers, plywood makers and related wood processing workers
- 7–33 Paper pulp preparers
- 7–34 Paper makers

7–4 Chemical Processers and Related Workers
- 7–41 Crushers, grinders and mixers
- 7–42 Cookers, roasters and related heat treaters
- 7–43 Filter and separator operators
- 7–44 Still and reactor operators
- 7–45 Petroleum refining workers
- 7–49 Chemical processers and related workers not elsewhere classified

7–5 Spinners, Weavers, Knitters, Dyers and Related Workers
- 7–51 Fibre preparers
- 7–52 Spinners and winders
- 7–53 Weaving and knitting machine setters and patterncard preparers
- 7–54 Weavers and related workers
- 7–55 Knitters
- 7–56 Bleachers, dyers and textile product finishers
- 7–59 Spinners, weavers, knitters, dyers and related workers not elsewhere classified

7–6 Tanners, Fellmongers and Pelt Dressers
- 7–61 Tanners and fellmongers
- 7–62 Pelt dressers

7–7 Food and Beverage Processers
- 7–71 Grain millers and related workers
- 7–72 Sugar processers and refiners
- 7–73 Butchers and meat preparers
- 7–74 Food preservers
- 7–75 Dairy product processers
- 7–76 Bakers, pastry cooks and confectionery makers
- 7–77 Tea, coffee and cocoa preparers
- 7–78 Brewers, wine and beverage makers
- 7–79 Food and beverage processers not elsewhere classified

7–8 Tobacco Preparers and Tobacco Product Makers
- 7–81 Tobacco preparers
- 7–82 Cigar makers
- 7–83 Cigarette makers
- 7–89 Tobacco preparers and tobacco product makers n.e.c.

7–9 Tailors, Dressmakers, Sewers, Upholsterers and Related Workers
- 7–91 Tailors and dressmakers
- 7–92 Fur tailors

7–93 Milliners and hatmakers
7–94 Patternmakers and cutters
7–95 Sewers and embroiderers
7–96 Upholsterers and related workers
7–99 Tailors, dressmakers, sewers, upholsterers and related workers not elsewhere classified.

8–0 Shoemakers and Leather Goods Makers
8–01 Shoemakers and shoe repairers
8–02 Shoe cutters, lasters, sewers and related workers
8–03 Leather goods makers

8–1 Cabinetmakers and Related Wood Workers
8–11 Cabinetmakers
8–12 Woodworking-machine operators
8–19 Cabinetmakers and related wood workers not elsewhere classified

8–2 Stone Cutters and Carvers
8–20 Stone cutters and carvers

8–3 Blacksmiths, Toolmakers and Machine Tool Operators
8–31 Blacksmiths, hammersmiths and forging-press operators
8–32 Toolmakers, metal pattern makers and metal markers
8–33 Machine tool setter-operators
8–34 Machine tool operators
8–35 Metal grinders, polishers and tool sharpeners
8–39 Blacksmiths, toolmakers and machine tool operators not elsewhere classified

8–4 Machinery Fitters, Machine Assemblers and Precision Instrument Makers (except Electrical)
8–41 Machinery fitters and machine assemblers
8–42 Watch, clock and precision instrument makers
8–43 Motor vehicle mechanics
8–44 Aircraft engine mechanics
8–49 Machinery fitters, machine assemblers and precision instrument makers (except electrical) not elsewhere classified

8–5 Electrical Fitters and Related Electrical and Electronics Workers
8–51 Electrical fitters
8–52 Electronics fitters
8–53 Electrical and electronic equipment assemblers
8–54 Radio and television repairmen
8–55 Electrical wiremen
8–56 Telephone and telegraph installers
8–57 Electric linemen and cable jointers
8–59 Electrical fitters and related electrical and electronics workers not elsewhere classified

8–6 Broadcasting Station and Sound Equipment Operators and Cinema Projectionists
8–61 Broadcasting station operators
8–62 Sound equipment operators and cinema projectionists

8–7 Plumbers, Welders, Sheet Metal and Structural Metal Preparers and Erectors
8–71 Plumbers and pipe fitters
8–72 Welders and flame cutters
8–73 Sheet metal workers
8–74 Structural metal preparers and erectors

8–8 Jewellery and Precious Metal Workers
- 8–80 Jewellery and precious metal workers

8–9 Glass Formers, Potters and Related Workers
- 8–91 Glass formers, cutters, grinders and finishers
- 8–92 Potters and related clay and abrasive formers
- 8–93 Glass and ceramics kilnmen
- 8–94 Glass engravers and etchers
- 8–95 Glass and ceramics painters and decorators
- 8–99 Glass formers, potters and related workers not elsewhere classified

9–0 Rubber and Plastics Product Makers
- 9–01 Rubber and plastics product makers (except tyre makers and tyre vulcanisers)
- 9–02 Tyre makers and vulcanisers

9–1 Paper and Paperboard Products Makers
- 9–10 Paper and paperboard products makers

9–2 Printers and Related Workers
- 9–21 Compositors, typesetters and phototype-setters
- 9–22 Printing pressmen
- 9–23 Stereotypers and electrotypers
- 9–24 Printing engravers (except photo-engravers)
- 9–25 Photo-engravers
- 9–26 Bookbinders and related workers
- 9–27 Photographic darkroom workers
- 9–29 Printers and related workers not elsewhere classified

9–3 Painters
- 9–31 Painters, construction
- 9–39 Painters not elsewhere classified

9–4 Production and Related Workers not elsewhere classified
- 9–41 Musical instrument makers and tuners
- 9–42 Basketry weavers and brush makers
- 9–43 Non-metallic mineral product makers
- 9–49 Other production and related workers

9–5 Bricklayers, Carpenters and Other Construction Workers
- 9–51 Bricklayers, stonemasons and tile setters
- 9–52 Reinforced-concreters, cement finishers and terrazzo workers
- 9–53 Roofers
- 9–54 Carpenters, joiners and parquetry workers
- 9–55 Plasterers
- 9–56 Insulators
- 9–57 Glaziers
- 9–59 Construction workers not elsewhere classified

9–6 Stationary Engines and Related Equipment Operators
- 9–61 Power generating machinery operators
- 9–69 Stationary engine and related equipment operators not elsewhere classified

9–7 Material-Handling and Related Equipment Operators, Dockers and Freight Handlers
- 9–71 Dockers and freight handlers
- 9–72 Riggers and cable splicers
- 9–73 Crane and hoist operators
- 9–74 Earth-moving and related machinery operators
- 9–79 Material-handling equipment operators not elsewhere classified

9–8 Transport Equipment Operators
- 9–81 Ships. deck ratings, barge crews and boatmen
- 9–82 Ships' engine room ratings
- 9–83 Railway engine drivers and firemen
- 9–84 Railway brakemen, signalmen and shunters
- 9–85 Motor vehicle drivers
- 9–86 Animal and animal-drawn vehicle drivers
- 9–89 Transport equipment operators not elsewhere classified

9–9 Labourers not elsewhere classified
- 9–99 Labourers not elsewhere classified

MAJOR GROUP X: WORKERS NOT CLASSIFIABLE BY OCCUPATION

X–1 New Workers Seeking Employment
X–2 Workers Reporting Occupations Unidentifiable or Inadequately Described
X–3 Workers NOT Reporting Any Occupation

ARMED FORCES

Members of the Armed Forces

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INDEX